

Final Environmental Impact Statement



Green River Diversion Rehabilitation Project

Emery and Grand Counties, Utah

Sponsoring
Local Organization:



Prepared For:



Cooperating Agency:



Prepared By: **McMILLEN, LLC**

June 2014

Title and Document Status: Final Environmental Impact Statement (FEIS) for the Rehabilitation of the Green River Diversion

Lead Agency: U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS)

Cooperating Agency: U.S. Department of the Interior Bureau of Land Management (BLM)

Sponsor/Local Organization: Utah Department of Agriculture and Food (UDAF)

Authority: This FEIS has been prepared under the authority of the Emergency Watershed Protection (EWP) program (7 CFR Part 624) and in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969 (NEPA), Public Law 91-190, as amended (42 U.S.C. 4321 et seq.).

Abstract: The Green River/Tusher Diversion was constructed in the early 1900s and has been modified over the years to maintain the structure. During the 2010/2011 flood events, flows in the Green River caused severe damage to the diversion structure, compromising its structural integrity. In the event of diversion failure, water service to three irrigation canals, the City of Green River, a historic irrigation water delivery system, and one hydropower plant would be eliminated. Rehabilitating the diversion would directly result in these resources remaining usable for the water rights holders. The NRCS and UDAF have analyzed alternatives to maintain the existing functions of the diversion for water delivery to irrigation canals and upgrade the diversion structure to current design standards, as well as provide upstream and downstream fish passage and tracking, fish screening, enhanced sediment sluicing, and downstream recreational boat passage. The fish protection and passage components are proposed for inclusion in the project to meet Endangered Species Act requirements for listed fish species populations in the Green River. The boat passage provision is a navigability requirement of the state of Utah.

Comments: NRCS has completed this FEIS in accordance with the NEPA and NRCS guidelines and standards, and invited the public to participate in the NEPA process. A notice of availability of the Draft EIS was mailed to interested parties on March 14, 2014, published in local newspapers (The Sun Advocate, the Moab Times-Independent, Salt Lake Tribune, Emery County Progress, Deseret News, and ETV News) on March 14, March 20, and April 3, 2014, and posted to the NRCS project website (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/ut/programs/planning/wr/>) on March 14, 2014. The public was invited to provide oral, written, or e-mail comments on the Draft EIS between March 14 and April 30, 2014. Hard copies of the Draft EIS were sent to the NRCS Price Field Office, the Grand County Public Library, Green River City Hall, and the John Wesley Powell River History Museum for public viewing. An electronic copy was made available to agencies and the public on the project website. Comments received by the close of the comment period were considered in preparing this FEIS.

NRCS received 76 comments from the general public and various organizations, as well as 7 comments from local, State and Federal agencies on the Draft EIS. Appendix A of this FEIS provides copies of the comments. Further information may be obtained for this project by contacting the following NRCS personnel:

David Brown
NRCS Utah State Conservationist
125 South State Street, Room 4010
Salt Lake City, UT 84138-1100
801-524-4555
David.brown@ut.usda.gov

Non-Discrimination Statement: The U.S. Department of Agriculture prohibits discrimination against its customers. If you believe you have experienced discrimination when obtaining services from USDA, participating in a USDA program, or participating in a program that receives financial assistance from USDA, you may file a complaint with USDA. Information about how to file a discrimination complaint is available from the Office of the Assistant Secretary for Civil Rights. USDA prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex (including gender identity and expression), marital status, familial status, parental status, religion, sexual orientation, political beliefs, genetic information, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.)

To file a complaint of discrimination, complete, sign, and mail a program discrimination complaint form, available at any USDA office location or online at www.ascr.usda.gov, or write to:

USDA
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW.
Washington, DC 20250-9410

Or call toll free at (866) 632-9992 (voice) to obtain additional information, the appropriate office or to request documents. Individuals who are deaf, hard of hearing, or have speech disabilities may contact USDA through the Federal Relay service at (800) 877-8339 or (800) 845-6136 (in Spanish). USDA is an equal opportunity provider, employer, and lender.

Persons with disabilities who require alternative means for communication of program information (e.g., Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

TABLE OF CONTENTS

Acronyms and Abbreviations	viii
CHAPTER 1. Introduction.....	1-1
1.1. Introduction	1-1
1.2. Authority	1-1
1.2.1. Emergency Watershed Protection (EWP) Program	1-1
1.2.2. Cooperating and Participating Agencies	1-3
1.3. Existing Conditions	1-3
1.3.1. Irrigation System	1-7
1.3.2. Tusher Wash.....	1-11
1.3.3. Hydropower Plant	1-12
1.4. Project Scope.....	1-14
1.4.1. Project Scoping Efforts and History	1-14
1.5. Purpose and Need	1-16
1.5.1. Purpose of the Proposed Action	1-16
1.5.2. Need for the Proposed Action.....	1-16
1.5.3. Laws, Regulations, Policies and Determinations.....	1-16
1.5.4. Resources Studied In Detail	1-19
1.5.5. Resources Eliminated From Further Study	1-19
CHAPTER 2. Affected Environment	2-1
2.1. Soil Resources.....	2-1
2.1.1. Geology.....	2-2
2.1.2. Stream Bank Erosion	2-2
2.1.3. Sedimentation	2-3
2.1.4. Prime and Unique Farmlands	2-3
2.2. Water Resources	2-6
2.2.1. Water Quality	2-6
2.2.2. Hydrology	2-7
2.2.3. Water Rights	2-7
2.2.4. Groundwater	2-10
2.2.5. Floodplains.....	2-10
2.2.6. Waters of the U.S. including Wetlands	2-10
2.2.7. Climate - Local	2-10
2.2.8. Climate Change	2-11
2.3. Air Quality	2-13

2.3.1.	National Ambient Air Quality Standards	2-13
2.3.2.	Climate and Greenhouse Gases	2-13
2.4.	Plants	2-13
2.4.1.	Vegetation Communities.....	2-13
2.4.2.	Endangered and Threatened Species and Species of Concern	2-15
2.4.3.	Invasive Plant Species and Noxious Weeds	2-16
2.5.	Animals	2-17
2.5.1.	Fish and Wildlife Habitat	2-17
2.5.2.	Endangered and Threatened Species and Species of Concern	2-18
2.5.3.	Invasive Fish and Wildlife Species	2-22
2.5.4.	Migratory Birds/Bald and Golden Eagles.....	2-22
2.6.	Human Environment	2-23
2.6.1.	Socioeconomics.....	2-23
2.6.2.	Cultural Resources/Historic Properties.....	2-28
2.6.3.	Hazardous, Toxic, and Radioactive Waste (HTRW)	2-30
2.6.4.	Recreation.....	2-30
2.6.5.	Public Health and Safety	2-35
2.6.6.	Visual/Aesthetics and Scenic Beauty	2-36
2.6.7.	Land Use.....	2-39
2.6.8.	Infrastructure.....	2-39
2.6.9.	Noise.....	2-40
CHAPTER 3.	Alternatives	3-1
3.1.	Formulation Process	3-1
3.2.	Alternative Concepts and Options Considered but Eliminated from Detailed Study	3-1
3.2.1.	Conceptual Alternatives	3-2
3.3.	Proposed Action.....	3-3
3.4.	Alternatives Analyzed	3-4
3.4.1.	No Action Alternative	3-4
3.4.2.	Replace In Place Alternative.....	3-4
3.4.3.	Replace In Place With Passages Alternative	3-8
3.5.	Past, Present, and Reasonably Foreseeable Projects	3-12
3.5.1.	Cumulative Impact Area	3-12
3.6.	Preferred Alternative	3-13
3.6.1.	Mitigation.....	3-13
3.6.2.	Operation and Maintenance	3-14

CHAPTER 4. Environmental Consequences	4-1
4.1. Summary and Comparison of Alternatives	4-2
4.2. Soil Resources	4-5
4.2.1. Geology, Stream Bank Erosion, and Sedimentation	4-5
4.2.2. Prime and Unique Farmlands	4-6
4.3. Water Resources	4-7
4.3.1. Water Quality	4-7
4.3.2. Hydrology	4-9
4.3.3. Water Rights	4-10
4.3.4. Groundwater	4-12
4.3.5. Floodplains	4-12
4.3.6. Waters of the U.S. and Wetlands	4-13
4.3.7. Climate Change	4-15
4.4. Air Quality	4-17
4.5. Plants	4-18
4.5.1. Vegetation and Riparian Communities	4-18
4.5.2. Endangered and Threatened Species and Species of Concern - Plants	4-20
4.5.3. Invasive Plant Species and Noxious Weeds	4-20
4.6. Animals	4-23
4.6.1. Habitat	4-23
4.6.2. Endangered and Threatened Species and Species of Concern	4-25
4.6.3. Invasive Fish Species	4-28
4.6.4. Migratory Birds/Bald and Golden Eagles	4-30
4.7. Human Environment	4-31
4.7.1. Socioeconomics	4-31
4.7.2. Cultural Resources and Historic Properties	4-32
4.7.3. Hazardous Materials	4-34
4.7.4. Recreation	4-35
4.7.5. Public Health and Safety	4-36
4.7.6. Visual Quality, Aesthetics and Scenic Beauty	4-39
4.7.7. Land Use	4-40
4.7.8. Infrastructure	4-40
4.7.9. Noise	4-41
4.8. Cumulative Effects	4-41
4.8.1. No Action Alternative	4-41
4.8.2. Replace In Place Alternative	4-42
4.8.3. Preferred Alternative - Replace In Place With Passages	4-42

4.9. Hazard Potential of Each Alternative	4-43
4.10. Consistency with Approved Regional Plans for Water Resource Management.....	4-44
4.11. Relationship between Short-Term Uses and Long-Term Productivity	4-45
4.12. Irreversible and Irretrievable Resource Commitments	4-45
4.12.1. No Action Alternative	4-46
4.12.2. Proposed Action – All Alternatives.....	4-46
4.13. Unresolved Issues	4-46
4.13.1. Flow Allocation Agreement	4-46
4.13.2. Operation and Maintenance (O & M) Plan	4-46
4.13.3. Biological Opinion	4-46
4.13.4. Cultural Resources Memorandum of Agreement and Treatment Plan	4-47
CHAPTER 5. Consultation, Coordination, and Public Participation	5-1
5.1. Introduction	5-1
5.2. Agency Consultation	5-1
5.3. Coordination.....	5-2
5.4. Project Chronology	5-2
5.5. Public Participation Plan	5-3
5.6. Project Scoping.....	5-4
5.6.1. Original Project Scoping Meeting	5-4
5.6.2. Second Public Scoping Meeting	5-5
5.6.3. Project Scoping Comments	5-5
5.7. Draft EIS	5-5
5.8. Final EIS	5-7
5.9. Record of Decision.....	5-7
CHAPTER 6. List of Preparers	6-1
6.1. EIS Preparers	6-1
CHAPTER 7. Distribution	7-1
7.1. Federal Government.....	7-1
7.2. Tribal Government	7-1
7.3. State Government.....	7-1
7.4. Local Government.....	7-1
7.5. Organizations.....	7-2
7.6. Businesses.....	7-2
7.7. Private Parties.....	7-3

CHAPTER 8. References8-1**TABLES**

Table 1-1.	Laws, Regulations and Agency Responsibilities	1-16
Table 1-2.	Resources Studied in Detail	1-19
Table 1-3.	Resources Eliminated from Further Study	1-19
Table 2-1.	NRCS Web Soil Survey Data	2-1
Table 2-2.	Peak Discharges For Various Return Periods, Above Green River Diversion	2-7
Table 2-3.	Water Rights for Study Area.....	2-7
Table 2-4.	GAP Analysis Summary	2-14
Table 2-5.	Federally-Listed Plant Species in Emery and Grand Counties, Utah	2-15
Table 2-6.	Noxious Weeds and Other Invasive Plants Potentially Present in the Study Area	2-16
Table 2-7.	Federally-listed Listed Species in Emery and Grand Counties, Utah	2-18
Table 2-8.	Land and Products Statistics for Emery and Grand Counties.....	2-24
Table 2-9.	Population Characteristics by State, County, and City in 2010.....	2-24
Table 2-10.	Past, Current, and Future Population	2-25
Table 2-11.	Population Composition by Race and Ethnicity in 2010	2-25
Table 2-12.	Labor Force Characteristics in 2010.....	2-26
Table 2-13.	Employment by Industry in 2010	2-27
Table 2-14.	Median Income in 2010	2-28
Table 2-15.	Poverty Rates in 2010	2-28
Table 2-16.	Cultural and Historic Sites in the Study Area.....	2-29
Table 2-17.	Green River State Park Facilities and Services.....	2-31
Table 2-18.	Public Health and Safety Services and Facilities in the Project Area.....	2-35
Table 3-1.	Preferred Alternative – Mitigation Commitments.....	3-13
Table 4-1.	Summary and Comparison of Direct, Indirect, and Short-Term Resource Impacts.....	4-2
Table 4-2.	Water Demands - Replace In Place With Passages Alternative.....	4-11
Table 4-3.	Summary of Impacts to Waters of the U.S., including Wetlands	4-14
Table 4-4.	Summary of Impacts to Plant Communities	4-19
Table 4-5.	Summary of Impacts to Fish and Wildlife Habitat*	4-24
Table 4-6.	USFWS Listed Species and Effects Determinations.....	4-26
Table 4-7.	Cultural Resources Found in the APE – Summary	4-33
Table 5-1.	Public Outreach Activities.....	5-2
Table 5-2.	DEIS Comments.....	5-6
Table 6-1.	List of Preparers	6-1

FIGURES

Figure 1-1.	Vicinity Map	1-2
Figure 1-2.	Green River Watershed.....	1-5
Figure 1-3.	Project Area Map.....	1-13
Figure 1-4.	Diversion Project Area Map.....	1-15
Figure 2-1.	Soil Resources, Including Prime and Unique Farmland.....	2-5

Figure 2-2. Water Resources, Water Right.....	2-9
Figure 2-3. Water Resources, Floodplains, and Waters of the U.S. including Wetlands	2-12
Figure 2-4. Critical Habitat	2-21
Figure 2-5. Recreation Map	2-34
Figure 3-1. Replace In Place Alternative	3-6
Figure 3-2. Replace In Place Alternative Cross Section.....	3-7
Figure 3-3. Replace In Place With Passages Alternative	3-9
Figure 3-4. Replace In Place With Passages East Side Canal Component.....	3-10
Figure 3-5. Staging and Access	3-11
Figure 3-6. Preferred Alternative – Staging, Access and ESC	3-16
Figure 4-1. Impacts to Waters of the U.S.....	4-16
Figure 4-2. Impacts to Plants	4-22
Figure 4-3. Impacts to Critical Habitat.....	4-29
Figure 4-4. Impacts to Recreation.....	4-38

PICTURES

Picture 1-1. East End of Diversion	1-6
Picture 1-2. West End of Diversion	1-6
Picture 1-3. Example of Damaged Area	1-7
Picture 1-4. Water Wheel at Hastings Ranch, East Bank.....	1-8
Picture 1-5. East Side Fish Passage	1-9
Picture 1-6. West End of Diversion	1-10
Picture 1-7. West Side Raceway Headgate Structure	1-10
Picture 1-8. West Side Sluice Gate.....	1-11
Picture 1-9. Tusher Wash Entrance into the Green River	1-12
Picture 2-1. Looking Northwest Toward Beckwith Butte.....	2-37
Picture 2-2. Looking North Northwest across Diversion Structure.....	2-37
Picture 2-3. New and Old Water Wheel at the Hastings Ranch, East Side.....	2-38
Picture 2-4. Damaged Diversion Structures, East Side	2-38

APPENDICES

A	Comments and Responses, Project Scoping
	Draft EIS Comments
	Commenter Category Matrix
	Draft EIS Public Meeting Sign-In Sheet
	Notice of Draft EIS
	Draft EIS Public Mailer
	Draft EIS NOA
	Green River Diversion Rehabilitation-Environmental Assessment Scoping Report
	Green River Diversion Rehabilitation-Environmental Impact Statement Scoping Report
B	Conceptual Design
	Final Concept Design Report

- C Supporting Documentation
 - NRCS Green River Diversion Damage Survey Report
 - Water Resources – Water Rights
 - BLM Plant Survey Memo
 - Waters of the U.S. and Wetlands Delineation Report
 - Biological Assessment
 - Species of Concern Memo
- D Project Coordination
 - EA to EIS Meeting Minutes 3-4-2013
 - USFWS 2nd Scoping Period Comment Letter 7-1-2013
 - Cultural Resources - Concurrence
 - SHPO Concurrence 10-16-2013
 - UDWR FF&SL Concurrence 10-21-2013
 - BLM Concurrence 1-17-2014
 - UDAF Concurrence 2-10-2014
 - Cultural Resource Survey Consultation Request Letters
 - Utah FFSL Letter 1-31-2014
 - Cultural Meeting Minutes 2-6-2014
 - Recreation Meeting Minutes 2-13-2014
 - Recreation Meeting Attendees
 - Project Meeting Minutes 2-18-2014
 - Project Meeting Minutes 3-3-2014
 - Project Meeting Minutes 3-6-2014
 - Project Meeting Minutes – Passages 4-24-2014

ACRONYMS AND ABBREVIATIONS

ac-ft	acre-feet
ACHP	Advisory Council for Historic Preservation
AGFD	Arizona Game and Fish Department
APE	Area of Potential Effect
BLM	Bureau of Land Management
BMPs	Best Management Practices
BOR	Bureau of Reclamation
CBD	Center for Biological Diversity
CCS	Center for Climate Strategies
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH ₄	methane
CO	carbon monoxide
CO ₂	carbon dioxide
cm	centimeter
CWA	Clean Water Act
DAQ	Division of Air Quality
DCH	Designated Critical Habitat
Draft EA	Draft Environmental Assessment
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EDR	Environmental Data Resources, Inc.
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
EWP program	Emergency Watershed Protection Program
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FFSL	Forestry, Fire and State Lands (Utah Division of)
FR	Federal Register
GHG	greenhouse gas
GRCC	Green River Canal Company
HTRW	hazardous, toxic, and radioactive waste
kg	kilogram
LUC	Land Use Code
LUHNA	Land Use History of North America
MBTA	Migratory Bird Treaty Act
mg/L	milligrams per liter
MOA	Memorandum of Agreement
MSAT	Mobile Air Source Toxics
N ₂ O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act

NHPA	National Historic Preservation Act
NO ₂	nitrogen dioxide
NOI	Notice of Intent
NO _x	nitrous oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
O ₃	ozone
OHV	off-highway vehicle
Pb	lead
PFO	palustrine forested
PIT	passive integrated transponder
PM	particulate matter
PSS	palustrine scrub-shrub
RM	River Mile
ROD	Record of Decision
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SEUTP	Southeast Utah Tamarisk Partnership
SHPO	State Historic Preservation Office
SO ₂	sulfur dioxide
SWPPP	Storm Water Pollution Prevention Plan
T&E	threatened and endangered
TMDL	total maximum daily load
UAC	Utah Administrative Code
UACD	Utah Association of Conservation Districts
UCDC	Utah Conservation Data Center
UDAF	Utah Department of Agriculture and Food
UDEQ	Utah Department of Environmental Quality
UDEQ-DWQ	Utah Department of Environmental Quality - Division of Water Quality
UDNR	Utah Department of Natural Resources
UDWRe	Utah Division of Water Resources
UDWRi	Utah Division of Water Rights
UDWR	Utah Division of Wildlife Resources
UGS	Utah Geological Survey
UPDES	Utah Pollutant Discharge Elimination System
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWCA	Utah Weed Control Association
UWRL	Utah Water Research Laboratory
VOC	volatile organic compound

CHAPTER S. Summary

S.1. Background of the Project

Flooding in 2011 heightened concerns that a catastrophic failure of the diversion could result in significant losses to the local agricultural economy. The effects of recent flooding include cracking and chipping of concrete, undercutting of the downstream foundation sediments, and cracks associated with structural failure. This damage prompted the Green River Conservation District and, subsequently, the Utah Department of Agriculture and Food (UDAF) to move forward with plans to rehabilitate the existing Green River Diversion, also known as the Tusher Diversion.

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) is working with UDAF through the Emergency Watershed Protection (EWP) Program to rehabilitate the existing Green River Diversion (diversion) system that will continue to provide water delivery to water rights holders.

Agency and stakeholder participation, along with public involvement, are key components that lead the NEPA process. Project information was made available to the public during the first scoping period from October 30, 2012 to November 30, 2012. A public scoping meeting was held on November 15, 2012 at the Green River City Hall. Numerous meetings with agency officials and stakeholders occurred during that time period. Based on the results of these scoping efforts, an Environmental Assessment (EA) was determined to be the correct course of action for the project.

Consultation with the Utah State Historic Preservation Office (SHPO) resulted in a determination that the diversion is historic and may be eligible for listing on the National Register of Historic Places (NRHP). Consequently, any modifications to the diversion may result in an adverse effect to the historic resource. This study has included a wide range of alternatives (as detailed in Chapter 3, Alternatives), some of which would result in impacts to the diversion considered “significant” to cultural resources.

Due to the potential for a significant resource impact, NRCS decided to prepare an Environmental Impact Statement (EIS) for the project instead of an EA. The Notice of Intent (NOI) to prepare an EIS was published, and a second scoping period was opened from May 29, 2013 to July 2, 2013.

The Draft EIS (DEIS) was made available for public comment on March 14, 2014 through April 30, 2014. A public meeting was held in Green River, Utah on April 10, 2014 at the John Wesley Powell River History Museum. All comments received during the comment period have been addressed in the Final EIS.

S.1.2 Changes from the DEIS

Appendix A includes a complete comment matrix that lists each comment received during the DEIS Public Comment Period along with a response. Revisions to the DEIS have been made in direct response to the comments and are reflected in this document.

S.2. Purpose and Need

S.2.1. Purpose of the Proposed Action

The purpose of the proposed action is to rehabilitate the existing Green River Diversion. The project would rehabilitate the diversion due to damage caused by past flood events, upgrade the diversion infrastructure to current design standards, maintain the level of water delivery to the existing water rights holders, and comply with applicable Federal rules and regulations.

S.2.2. Need for the Proposed Action

The need for the project is to maintain existing functions of the diversion for water delivery to water rights holders (irrigation canals and the powerhouse).

S.3. Proposed Action

The Proposed Action would rehabilitate the Green River Diversion, which is necessary due to damage caused by past flood events; upgrade the diversion infrastructure to current design standards; maintain the level of water delivery to the existing water rights holders; and, comply with applicable Federal rules and regulations. The Proposed Action would maintain existing functions of the diversion for water delivery to water rights holders, thereby meeting the Project Purpose and Need.

Based on the screening of the range of alternatives that accounted for water right delivery, engineering practicability, environmental impacts, and public and participating agency input, the Proposed Action is recommended (the “preferred alternative” is a combination of the components, and is decided upon in the Final EIS). The Proposed Action is a list of alternative components that were favored by the public, cooperating and participating agencies.

- Replace existing diversion structure.
- Level structure crest elevation to 4086.7’ to ensure water delivery to both east and west canals.
- Move sediment through the system and maintain floodwater conveyance.
- Replace existing gate and bridge at west raceway and provide sufficient water for bypass flows at fish protection systems.
- Improve east side raceway to water wheel.
- Dredge the large deposition area at the mouth of Tusher Wash for a source of cobble and gravel during construction.
- Construct a new siphon intake at the east side canal.
- Install deflection log booms at the east and west ends for public safety and structure protection.
- Reinforce the diversion structure with riprap.

- Provide upstream fish passage past diversion structure.
- Provide downstream fish passage via notches in the diversion structure.
- Provide passive integrated transponder (PIT) tag detectors to sense and record fish movement over and around the diversion.
- Install fish screen and bypass at the east side canal.
- Provide both dry and wet downstream boat passage past the diversion structure.
- Install boater warning signs upstream of the diversion for public safety.

S.4. Summary of Alternatives Analysis

The process of formulating alternatives for rehabilitation of the diversion followed procedures outlined in the NRCS National Environmental Compliance Handbook (USDA NRCS 2011). Numerous alternatives were developed by the project team based on the ability to address the purpose and need of the project. Some of the initial alternatives were eliminated from further analysis due to high cost or other critical factors. The project team developed a series of questions and filters to help formulate alternatives:

- *Initial Screening Question:* - Does the concept/alternative meet purpose and need?
Several alternatives were eliminated from further study upon the application of the initial screening question. A baseline alternative was developed at this stage of the process to demonstrate rehabilitation of the diversion.
- *Secondary Post-Scoping Screening Filters:*
 - Is it consistent with established design criteria, engineering practices, etc.?
 - Is it reasonable and feasible, and within the established NRCS EWP scope of work?

S.4.1. No Action Alternative

The No Action Alternative would consist of using no Federal money to rehabilitate the Green River Diversion. Due to the cost associated with the rehabilitation of the diversion, it is likely that no repairs would be made by the stakeholders to the severely damaged structure; it would not be upgraded to current engineering standards and technology, and would provide very limited fish passage and no boat passage. The sediment control/slucice gates would also remain in their current condition. This alternative, therefore, represents the scenario in which the diversion would likely fail during an extreme flood event in the future.

S.4.2. Replace In Place Alternative

This baseline alternative would replace the diversion at the same location or within close proximity to the existing diversion. The diversion structure or “weir” length would remain the same as the existing. This

alternative would maintain the existing east side and west side tie-in locations to the bank, where feasible. The alternative would upgrade the structure to current engineering standards and technology. The 750-foot, arc-shaped crest of the weir would be leveled to 4086.7' which would ensure delivery to water users. This alternative would include one new gate for water control and sluicing; and a new bulkhead gate structure and 80-foot raceway to the water wheel on the east side at the Hastings Ranch to maintain existing water rights. As part of the diversion rehabilitation, all water rights would be maintained.

On the west side of the diversion, the Green River Canal and powerhouse raceway would be controlled by the existing gate bridge/structure. To reduce debris collection and as a safety measure, two deflection log booms would be positioned across the raceway entrance. The 100-foot long west side and 170-foot long east side log booms would tie into a sluice gate in order to pass the debris past the weir and avoid blockages. At the east side, a new siphon intake for the East Side Canal would be constructed.

Downstream fish passage across the diversion would not be provided by this alternative. Upstream fish passage would be the same as existing passage on the east side of the structure.

The diversion structure itself would be designed for relatively safe passage over the diversion by boats during passable flows by creating a gradual slope that does not form an eddy that could trap boaters underwater. Boater warning signs would be placed at locations above the diversion on both banks.

This alternative would also require the temporary use of approximately 5.5 acres of BLM-managed public lands, 15.9 acres of state sovereign lands (Green River itself), and 2.3 acres of private lands for staging and access during construction.

S.4.3. Replace In Place With Passages Alternative

This alternative would demolish the existing diversion and install a new diversion in the same location. This alternative would replace the existing diversion along the current alignment and upgrade the structure to current engineering standards and technology. Replacing the existing structure would maintain the historic setting of the project site. The 750-foot, arc-shaped crest of the weir would be leveled to 4086.7' which would ensure delivery to water users. This alternative would include two new gates for water control and sluicing; and a new bulkhead gate structure and 80-foot raceway to the water wheel on the east side at the Hastings Ranch to maintain existing water rights. As part of the diversion rehabilitation, all water rights would be maintained.

On the west side of the diversion, the existing gate structure would be replaced to provide more efficient water control and sluicing capabilities for the Green River Canal and powerhouse raceway. To reduce debris collection and as a safety measure, two deflection log booms would be positioned across the raceway entrance. The 100-foot long west side and 170-foot long east side log booms would tie into a sluice gate in order to pass the debris over the weir and avoid blockages. At the east side, a new siphon intake for the East Side Canal would be constructed.

Downstream fish passage across the diversion would be provided along the length via notches in the structure. Adjacent to the water wheel raceway would be an upstream fish passage channel (10 feet wide and approximately 180 feet in length) that would be designed to accommodate fish during low flows. Passive integrated transponder (PIT) tag detectors would be placed at each downstream fish passage notch and at the entrance/exit of the upstream fish passage to sense and record fish movement over and around the diversion. A fish screen would be placed in the East Side Canal near the river, with passage back to the river. All concentrated fish passage areas would have PIT tag detectors to estimate population movement and numbers.

Boat passage components would provide additional debris removal benefits. This notch in the diversion structure would be located in the center of the diversion (refer to Appendix D for supporting documentation regarding the location of the boat passage). The boat passage section would consist of a stepped opening 30-feet wide by 2-feet deep in the diversion with a more gradual slope into the tailwater of the diversion to provide safer rafting over the diversion. The boat passage would be lined with concrete and flows could be regulated using a weir at the entrance. The diversion structure itself would be designed for safe passage over the dam during passable flows by creating a gradual slope that does not form an eddy that could trap boaters underwater. Boater warning signs would be placed at locations above the diversion on both banks.

This alternative includes the use of cobbles and gravel that have been deposited into the river channel below the diversion and at the confluence of Tusher Wash. This alternative would also require the temporary use of approximately 5.5 acres of BLM-managed public lands, 15.9 acres of state sovereign lands (Green River itself), and 2.3 acres of private lands for staging and access during construction.

S.5. Affected Environment

The *project area and/or vicinity* is defined as the area within approximately ½ mile to one mile of the Green River Diversion, including the private properties adjacent. The *study area* is much larger, typically county-wide.

Soils

- Soils in the study area have been mostly derived from the Mancos Shale. In the study area portion of Grand County, two soil types are prevalent, including the Redbank-Flatnose families association, and the Toddler-Ravola-Glenton families association. Emery County soils in the area include Beebe loamy fine sand, Ferron-Green River-Rafael complex, Garley-Ravola-Huntsman complex, Hunting loam, strongly saline, Penner loam, and Vickel-Utaline-Persayo complex. The dominant soils within the study area are characteristic of river valleys and floodplains and occur at elevations comparable to the diversion and surrounding area. There are minor amounts of prime farmland (if irrigated) and locally important farmland in the study area.

Water

- Water resources in the study area include the Green River, Tusher Wash, the Green River Canal, the Thayn Canal, the East Side Canal, and wetlands. Floodplains in the study area include those of the Green River in Grand County (Emery County is unmapped).

Air

- The project is located within an air quality attainment area.

Plants and Animals

- Habitat in the study area includes riparian along the river. The river supports common native and non-native fish species. Terrestrial habitats support wildlife that uses riparian areas and agricultural land.
- Four federally-listed fish species are known to use the project area: Bonytail, Colorado pikeminnow, Humpback chub, and Razorback sucker. Portions of the Green and Colorado rivers in Utah are designated as critical habitat for all four endangered fish species in the study area; consultation has verified that the study area is designated critical habitat for the razorback sucker and the Colorado pikeminnow. Three other federally-listed species are known to use the project area as well: Mexican spotted owl, Yellow-billed cuckoo and Southwestern willow flycatcher.
- Twelve other special-status species (species that are ESA candidates, identified by the State or BLM as sensitive or part of conservation agreements) could be present in the study area: the bald eagle, big free-tailed bat, bluehead sucker, burrowing owl, cornsnake, ferruginous hawk, flannelmouth sucker, Great Plains toad, roundtail chub, spotted bat, Townsend's big-eared bat, and the white-tailed prairie dog..

Humans

- **Socioeconomics, including Environmental Justice:** Compared to other areas of the nation and state, the study area has a higher-than-average unemployment in 2010 and a lower-than-average median income. In 2009, the market value of irrigated crops produced in Emery County was \$86.89 per acre, and in Grand County was \$301.52 per acre. There are potential environmental justice populations concentrated in the study area, however none of those populations have been identified in the project area.
- **Cultural Resources:** The diversion and the East Side Canal are eligible for listing on the National Register of Historic Places (NRHP), along with several other sites and structures. The project would have a significant adverse effect on the diversion and the East Side Canal. Mitigation for the adverse effects involves a treatment plan and a Memorandum of Agreement (MOA) between all parties.
- **Recreation:** The study area is located between The Beach/Swasey's Boat Ramp (BLM-managed facilities) to the north and Green River State Park to the south, which are camping and trail access areas. The BLM-managed lands west of the project are used for recreation access and OHV use. There is unauthorized use of canals and canal maintenance roads for recreation.
- **Scenic beauty and Visual Resources:** Landforms, buildings, water, and vegetation contribute to the overall scenic quality of the study area. The visual quality and landscape of the area is rural/agricultural.

S.6. Environmental Consequences of the Proposed Action

In summary, the project alternatives propose to adversely or beneficially effect the following resources:

- Water Resources
- Socioeconomics
- Cultural Resources
- Vegetation
- Threatened and Endangered Species
- Recreation

Table S-1 provides a comparison of impacts associated with each alternative, as well as recommended mitigation.

Table S-1. Summary and Comparison of Direct, Indirect, and Short-Term Resource Impacts

Effects	No Action	Replace In Place (Baseline)	Preferred Alternative: Replace In Place With Passages
Soils	<i>Direct Impacts:</i> None <i>Indirect effect</i> - scouring of soil downstream from diversion failure. Temporary Downstream Effects to 4,000 ac of cropland.	<i>Direct Impacts:</i> Approx 1100 cubic yards of cobble and gravel removed from the Tusher Wash deposition area and used to construct and/or support the diversion <i>Short-Term:</i> Potential soil disturbance and sediment into Green River during construction. Temporary disturbance to access roads and staging areas during construction.	<i>Direct Impacts:</i> Approx 1100 cubic yards of cobble and gravel removed from the Tusher Wash deposition area and used to construct and/or support the diversion <i>Short-Term:</i> Potential soil disturbance and sediment into Green River during construction. Temporary disturbance to access roads and staging areas during construction.
Prime and Unique Farmlands	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Temporary Downstream Effects to 4,000 ac of cropland.	<i>Direct Impacts:</i> None <i>Short-Term:</i> Temporary easement for access during const.	<i>Direct Impacts:</i> None <i>Short-Term:</i> Temporary easement for access during const.
Water Resources – Water Quality, Hydrology, Floodplains	<i>Direct Impacts:</i> None <i>Short-Term:</i> Flood clean-up activities would temporarily affect sediment levels in river channel.	<i>Direct Impacts:</i> 0.2 ac clearing and grubbing in the floodplain <i>Short-Term:</i> Temp disturbance to 15.9 ac of river channel; temporary work in the floodplain = 2.3 ac.	<i>Direct Impacts:</i> 0.2 ac clearing and grubbing in the floodplain <i>Short-Term:</i> Temp disturbance to 15.9 ac of river channel; temporary work in the floodplain = 2.3 ac
Waters of US including Wetlands	<i>Direct Impacts:</i> None <i>Indirect effects</i> to streams. Stream channel altered and wetlands washed away or filled with sediment from diversion failure.	<i>Direct Impacts:</i> 1.3 ac impact to open waters and to wetlands. <i>Short-Term:</i> 16.4 ac temporary impact to open waters; 0.2 ac temporary impact to wetlands.	<i>Direct Impacts:</i> 1.3 ac impact to open waters and wetlands. <i>Short-Term:</i> 16.4 ac temporary impact to open waters; 0.2 ac temporary impact to wetlands.
Climate Change	<i>Direct Impacts:</i> None	<i>Direct Impacts:</i> None	<i>Direct Impacts:</i> None
Air Quality	<i>Direct Impacts:</i> None <i>Indirect and Short-Term:</i> None	<i>Direct Impacts:</i> None <i>Short-Term:</i> Construction activities would temporarily affect air quality in the project area.	<i>Direct Impacts:</i> None <i>Short-Term:</i> Construction activities would temporarily affect air quality in the project area.

Effects	No Action	Replace In Place (Baseline)	Preferred Alternative: Replace In Place With Passages
Plants – Riparian Zone and Other	<i>Direct Impacts:</i> None <i>Short-Term:</i> Damage to vegetation downstream of diversion from failure.	<i>Direct Impacts:</i> 0.5 ac of impact <i>Short-Term:</i> Potential for additional impact in access and staging areas during construction.	<i>Direct Impacts:</i> 0.5 ac of impact <i>Short-Term:</i> Potential for additional impact in access and staging areas during construction.
Threatened and Endangered Species	<i>Direct Impacts:</i> Obstructed fish passage during low flows. <i>Short-Term:</i> Damage to species and habitat downstream of diversion from failure.	<i>Direct Impacts:</i> 1.3 acres of impact due to new riprap in channel; No downstream fish passage. Obstructed fish passage during low flows. No fish or wildlife kills anticipated. <i>Short-Term:</i> 15.9 ac of disturbance to the channel during construction (designated critical habitat).	<i>Direct Impacts:</i> 1.3 ac of impact due to new riprap in channel; no fish or wildlife kills anticipated. Enhancement of passages and installation of monitoring tools for improvement of habitat. <i>Short-Term:</i> 15.9 ac of disturbance to the channel during construction (designated critical habitat).
Fish	<i>Direct Impacts:</i> Obstructed fish passage during low flows. <i>Short-Term:</i> Possible destruction or modification of fish habitat in the channel downstream.	<i>Direct Impacts:</i> 1.3 acres of impact due to new riprap in channel; Obstructed fish passage during low flows. <i>Short-Term:</i> 15.9 ac of disturbance to the channel during construction	<i>Direct Impacts:</i> 1.3 acres of impact due to new riprap in channel; <i>Short-Term:</i> 15.9 ac of disturbance to the channel during construction
Wildlife	<i>Direct Impacts:</i> None <i>Short-Term:</i> Injury or fatality, as well as extreme habitat modifications, in the inundation area from diversion failure.	<i>Direct Impacts:</i> 0.5 acres of wildlife habitat impacted (riparian) <i>Short-Term:</i> Temp disturbance to project area	<i>Direct Impacts:</i> 0.5 acres of wildlife habitat impacted (riparian) <i>Short-Term:</i> Temp disturbance to project area
Socioeconomics	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Adverse effects damage to roads, access and property damages; loss of crops and jobs during floods. Temporary Downstream Effects to 4,000 ac of cropland.	<i>Direct Impacts:</i> None Alternative beneficial in the provision of a more reliable supply of water for irrigation and hydropower. <i>Short-Term:</i> Job creation during construction.	<i>Direct Impacts:</i> None. Alternative beneficial in the provision of a more reliable supply of water for irrigation and hydropower. <i>Indirect:</i> Possible increase in tourism, economy in the vicinity due to provision of boat passage. <i>Short-Term:</i> Job creation during construction.

Effects	No Action	Replace In Place (Baseline)	Preferred Alternative: Replace In Place With Passages
Cultural/Historic	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> historic diversion structure would be adversely affected in the extreme flood event.	<i>Direct Impacts:</i> Structure demolition and E Side Canal improvements a significant adverse effect. <i>Short-Term:</i> Construction activities, staging of equipment and materials, and river access temp impacts to eligible sites. Mitigate adverse effects through the development of a treatment plan formalized in a Memorandum of Agreement (MOA).	<i>Direct Impacts:</i> Structure demolition and E Side Canal improvements a significant effect. <i>Short-Term:</i> Construction activities, staging of equipment and materials, and river access temp impacts to eligible sites. Mitigate adverse effects through the development of a treatment plan formalized in a Memorandum of Agreement (MOA).
Recreation/Public Health & Safety	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> High hazard and loss-of-life potential in the event of diversion failure.	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Reduction of loss-of-life potential.	<i>Direct Impacts:</i> Enhanced recreation opportunities for the boating community due to provision for boat passage. <i>Indirect and/or Short-Term:</i> Reduction of loss-of-life potential.
Visual Quality/ Aesthetics/Scenic Beauty	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Extreme flood event and post-disaster clean-up activities would degrade the area temporarily.	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Construction site would degrade the area temporarily.	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Construction site would degrade the area temporarily.
Land Use/Rights	<i>Direct Impacts:</i> None <i>Short Term:</i> Temporary downstream effects to 4,000 ac of cropland.	<i>Direct Impacts:</i> None <i>Short-Term:</i> Temporary easement (approx.5.5 ac.) for BLM access during const. Special Use Lease (State of Utah) – 15.9 ac (temp. construction); 1.3 ac permanent easement.	<i>Direct Impacts:</i> None <i>Short-Term:</i> Temporary easement (approx.5.5 ac.) for BLM access during const. Special Use Lease (State of Utah) – 15.9 ac (temp. construction); 1.3 ac permanent easement.
Infrastructure - Transportation	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Adverse effects from damage to roads from a diversion failure. Loss of access during floods.	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Temporary affects to road during construction	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Temporary affects to road during construction

S.6.1. Hazard Potential of Each Alternative

There are no nearby areas of high landslide potential, and recent reconnaissance of geologic hazards did not reveal any evidence of active faults, landslides, or rockfalls in the study area (Alpha Engineering Company 2010). Seismic hazards are considered relatively low as well; therefore, the most significant hazard at the site is high water flows associated with extreme storm events (100-year event).

The No Action Alternative assumes that the existing diversion would remain in place and irrigation water delivery would continue as is currently. In the 100-year storm event, the following may occur:

- Diversion failure
- Flooding from storm water flows
- Damage to property, structures, roads, and people

The Replace In Place alternative is in the same general location and proposes a similar structure to divert water from the Green River. This alternative does not pose an increased risk nor does it involve additional hazard associated with the installation of a new structure. In general, this alternative would provide a decreased hazard potential as compared to existing conditions.

The Replace In Place With Passages alternative is in the same general location and proposes a similar structure to divert water from the Green River. This alternative does not pose an increased risk nor does it involve additional hazard associated with the installation of a new structure. In general, this alternative would provide a decreased hazard potential as compared to existing conditions.

S.6.2. Permits and Approvals

In addition to EWPP requirements and mitigation measures that might be identified as part of this EIS, construction of the action alternatives would require the following permits or authorizations:

- Endangered Species Act (ESA) Section 7 consultation and subsequent incidental take statement
- Special Use Permit/Lease: Bureau of Land Management (BLM), Utah Fire, Forestry, and State Lands (FFSL)
- Clean Water Act (CWA) Section 404 authorization for work within the Green River
- CWA Section 402 National Pollutant Discharge Elimination System (NPDES) general permit for construction-related stormwater discharges
- National Historic Preservation Act (NHPA) Section 106 concurrence and Memorandum of Agreement with the State Historic Preservation Officer (SHPO) for the proposed Adverse Effect to the Green River Diversion.
- Antidegradation review by the Utah Division of Water Quality for potential impacts to the Green River
- Construction easements from Emery and Grand Counties, as well as property owners within the project area.

S.7. Public Participation and Agency Consultation

Project scoping questions, comments, and concerns were requested from the public and government agencies during the preliminary scoping period, both orally at public meetings and via written submittal of comments. The main goal of public participation during the scoping period was to involve a diverse group of public and government agency participants to solicit input and provide timely information

regarding their concerns pertaining to the project and the proposed alternatives. The public was also invited to a DEIS public meeting to review the project conceptual design and the DEIS.

S.7.1. Original Public Scoping Meeting

A scoping notice was prepared and sent to interested parties and regulatory agencies on October 30, 2012. The scoping notice gave a description of the project, location and overview, purpose and need, identified preliminary scoping issues, and requested public participation. The scoping notice also identified the location of public meetings, contact information to submit written comments, and the scoping period closure date. One public scoping meeting was conducted on November 15, 2012. Written comments were submitted via mail, e-mail, facsimile, or comment card, and oral comments could have been submitted over the phone or in person. There were 11 oral or written comment documents received during the scoping period.

S.7.2. Second Public Scoping Meeting

Initially, it was determined that the project would follow NEPA guidelines through the EA process, and comments made during the first public scoping period as well as numerous agency meetings supported that. However, during consultation with the State Historic Preservation Officer, it was determined that the diversion could be of historic importance and possibly be eligible for listing on the NRHP. Consequently, any modification to the diversion might result in an adverse effect to the historic resource. The consequences of the action alternatives could result in impacts to the diversion considered “significant” to cultural resources. Due to the potential for a significant resource impact, NRCS decided to prepare an EIS for the project instead of an EA. The NOI to prepare an EIS was published and a second scoping period was opened during the period of May 29, 2013 to July 2, 2013.

The second public scoping meeting consisted of two Telebriefings on June 12, 2013. One was held at 2:00 PM to accommodate agency personnel and their schedules, and one at 6:00 PM to accommodate the general public and stakeholders. Written comments could have been submitted via mail, e-mail, facsimile, or comment card, and oral comments could have been submitted via phone or in person. There were 39 oral or written comment documents received for the Green River Diversion Project during the 2nd scoping period.

S.7.3. DEIS Public Meeting

A public notice describing the proposed project and providing notice of availability of the DEIS was mailed to interested parties (Chapter 7, Distribution) on March 14, 2014, published in local newspapers (The Sun Advocate, Moab Times-Independent, Salt Lake Tribune, Emery County Progress, Deseret News, and ETV News) on March 14 and April 3, 2014, and posted to the NRCS project website. The DEIS was released for public review and comment via the website and hard copies of the DEIS were sent to the NRCS Price Field Office, the Grand County Public Library, Green River City Hall, and the John Wesley Powell River History Museum for viewing between March 14 and April 30, 2014. One combined

agency and public DEIS meeting was conducted on April 10, 2014 at the John Wesley Powell River History Museum. There were 39 in attendance at the meeting.

The DEIS comment period was open between March 14 and April 30, 2014. Written comments could have been submitted via mail, e-mail, facsimile, or comment card, and oral comments could have been submitted via phone or in person. There were 83 oral or written comment documents received from both public and agencies for the Green River Diversion DEIS during the DEIS comment period.

S.7.4. Agency Involvement and Consultation

The Proposed Action would require work within BLM property. NRCS has coordinated with the BLM (a cooperating agency) regarding the project. A temporary use permit would be required for the staging and access for the construction activities associated with the project. Consultation with the BLM will be ongoing, and once the project design has advanced further coordination would be necessary for modification of the rights-of-way and/or easements. Further coordination with the BLM would be performed as the project progresses during final design.

The Proposed Action would require work on the bed of the Green River, within the project area, which is considered sovereign land owned by the State of Utah and managed by the Utah Division of Forestry, Fire and State Lands (a participating agency). A Special Use Lease would be required for the construction activities and the structure. Further consultation and coordination with FFSL will continue as the project progresses to ensure navigability through the Diversion.

NRCS has coordinated with Utah SHPO regarding the project under formal consultation. The report prepared for the project describing the results of the literature review and pedestrian survey concluded that there are cultural and historical resources within the project area. The report was submitted to Utah SHPO, and the agency concurred that the project would constitute an Adverse Effect to 2 NRHP-eligible sites, the Green River Diversion and the East Side Canal. A treatment plan to mitigate the adverse effects, along with a Memorandum of Agreement between the NRCS, UDAF, Green River Conservation District, BLM, FFSL, John Wesley Powell River History Museum, Mr. Chris Dunham, and the Utah SHPO has been completed and will be implemented during the course of the construction process.

Research and informal consultation with the USFWS (a participating agency) has concluded that the project will impact Threatened and Endangered species. A Biological Assessment has been prepared for the project which concludes that the proposed action May Affect, and is Likely to Adversely Affect four listed species, including the critical habitat of two of those species. Consultation will be formalized with the agency to provide further impact analysis and mitigation commitments to develop the Biological Opinion. The results of the consultation with USFWS on this project will be documented as part of the Record of Decision.

The Proposed Action would require work within jurisdictional waters of the U.S. A USACE Section 404 permit will be required to complete the construction activities associated with the project. Consultation

with the USACE will be performed once the project design has advanced to identify dredge/fill impacts (area and volume) to jurisdictional waters. The jurisdictional waters of the U.S. and wetland delineation identified that there will be impacts from the proposed action. Further coordination with the USACE will be performed in order to progress the project into final design.

CHAPTER 1. INTRODUCTION

1.1. Introduction

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) is working with the Utah Department of Agriculture and Food (UDAF) through the Emergency Watershed Protection (EWP) Program to rehabilitate the existing Green River Diversion (diversion) system (Figure 1-1) that will continue to provide water delivery to water rights holders.

Flooding in 2011 heightened concerns that a catastrophic failure of the diversion could result in significant losses to the local agricultural economy. The effects of recent flooding include cracking and chipping of concrete, undercutting of the downstream foundation sediments, and cracks associated with structural failure. This damage prompted the Green River Conservation District and, subsequently, UDAF to move forward with plans to rehabilitate the existing Green River Diversion, also known as the Tusher Diversion.

1.2. Authority

This Environmental Impact Statement (EIS) has been prepared under the authority of the EWP program (authorized by Section 216 of the Flood Control Act of 1950, Public Law 81-516, 33 U.S.C. 701b-1; and Section 403 of the Agricultural Credit Act of 1978, Public Law 95-334, as amended by Section 382, of the Federal Agriculture Improvement and Reform Act of 1996, Public Law 104-127, 16 U.S.C. 2203).

This document complies with the requirements of the National Environmental Policy Act of 1969 (NEPA), PL 91-190, as amended (42 U.S.C. 4321 et seq.), and its implementing regulations, which are set forth in the Council on Environmental Quality (CEQ) Regulations 40 CFR Parts 1500-1508; and NRCS NEPA policy and guidelines 70 CFR Part 650 (NRCS 2006 and 2011). The NEPA requires an evaluation of potential environmental impacts associated with federal actions.

1.2.1. Emergency Watershed Protection (EWP) Program

NRCS provides technical and financial assistance to communities that have been affected by natural disasters, including floods, fires, drought, hurricanes, etc. This kind of assistance is provided through the EWP program. The EWP program helps project sponsors and individuals implement emergency recovery measures to relieve imminent hazards to life and property created by a natural disaster that has caused a sudden impairment of a watershed (NRCS 2010a).

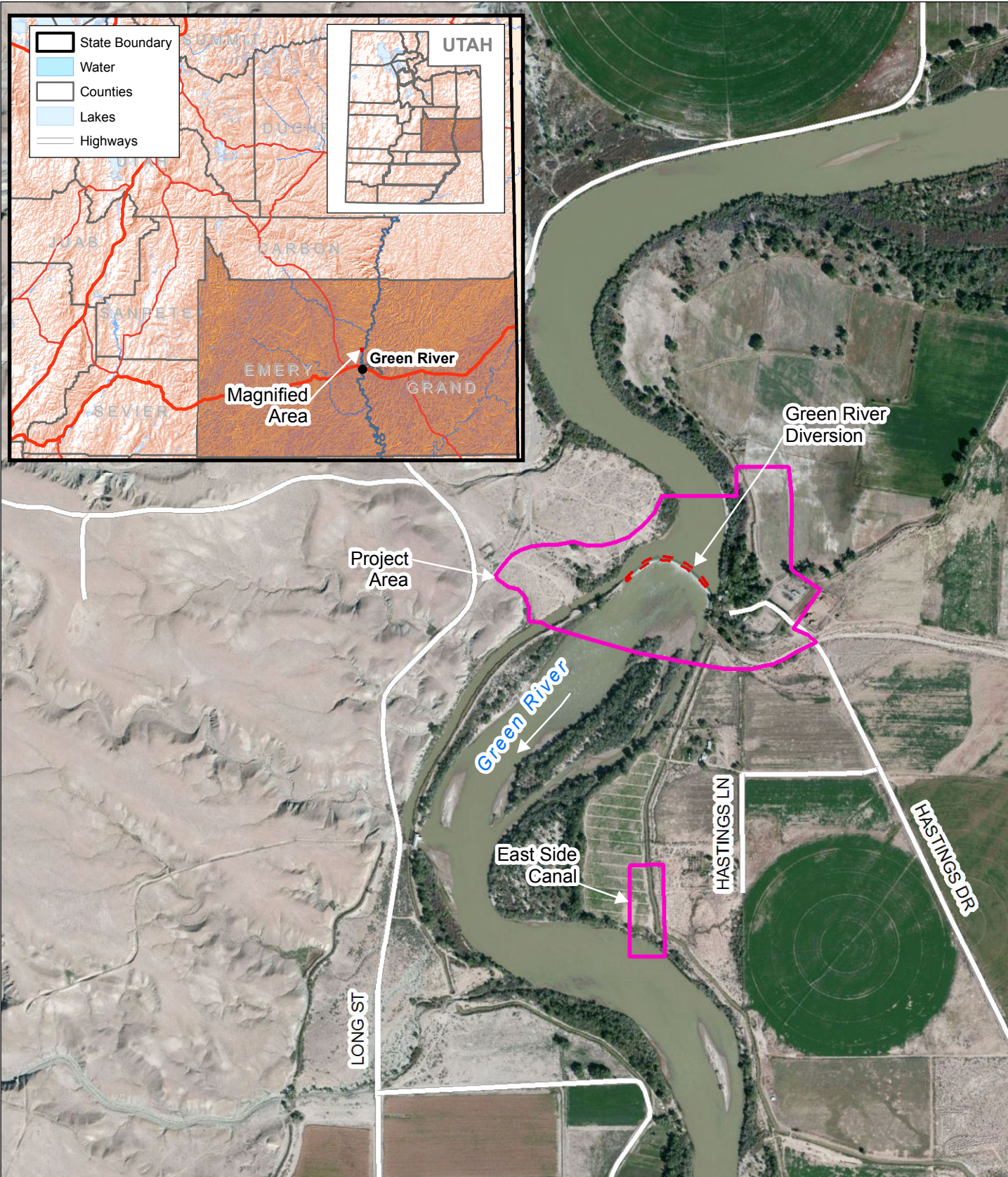


Figure 1-1: Vicinity Map

NRCS Green River Diversion Rehabilitation
Final EIS

0 500 1,000 2,000 Feet



McMILLEN, LLC
DESIGN with Vision. BUILD with Integrity



Legend

- Project Area
- Roads
- Green River Diversion Dam

NOTES:
Aerial photo from Bing imagery service. Capture date September 2010, Shaded reliefs derived from 10-m and 90-m USGS DEMs. Points, lines and polygons supplied by various state and federal sources, including BLM, UDOT, and USGS.

Rehabilitation of the diversion is eligible for funding under the EWP program, which authorizes funding (75% of project construction cost) and technical assistance (100% of design) to rehabilitate damage incurred to structures during natural disasters, including flood events.

A NEPA Programmatic Environmental Impact Statement (EIS) was prepared by the NRCS for the overall EWP program in 2004; however, the rehabilitation of this diversion does not fit within the analysis parameters of the Programmatic EIS. Therefore, this document has been prepared to comply with the additional NEPA analysis required for this project.

In addition to repairing damage, the EWP Program requires that structures be updated to current technology and design standards as specified in the EWP Program Manual, Title 390, Part 511.4.A(12) (NRCS 2010a). EWP Program measures must also adhere to all applicable Federal, State, Tribal, and local laws and regulations as specified in the EWP Program Manual, Title 390, Part 510.1. (NRCS 2010a).

1.2.2. Cooperating and Participating Agencies

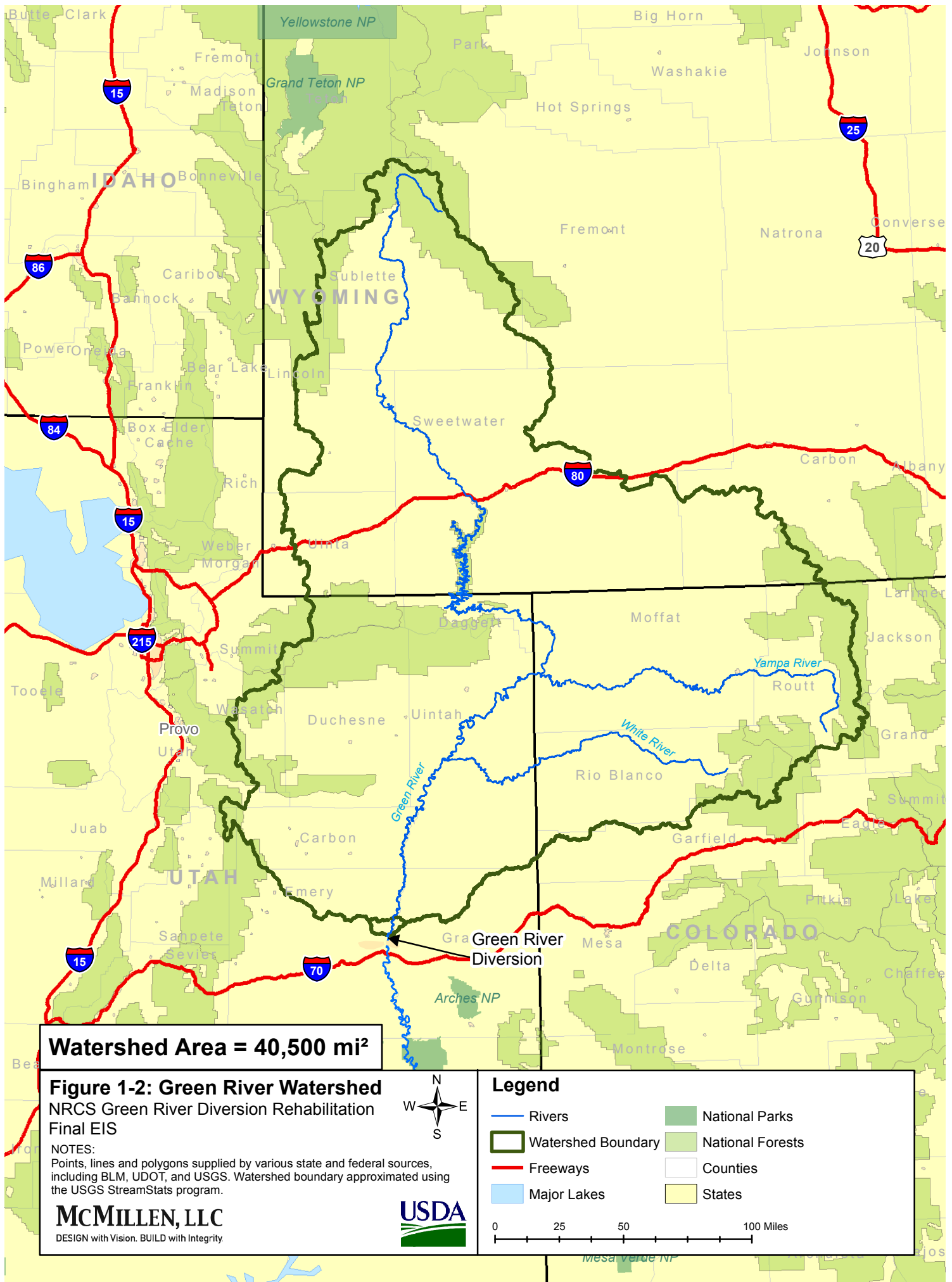
The CEQ's regulations implementing NEPA allow federal agencies (as lead agencies) to invite tribal, state, and local governments, as well as other federal agencies, to serve as cooperating agencies in the preparation of environmental impact statements. The NRCS, as the lead agency, invited those agencies with some close association with the project to be cooperating agencies. The Bureau of Land Management (BLM) accepted the invitation to be a Cooperating Agency. NRCS will also be coordinating with the Utah Division of Forestry, Fire and State Lands in regards to becoming a cooperating agency for the project. The following federal, state, and local government agencies have been involved in the process and are considered participating agencies. Section 5.2, Agency Consultation includes further description on the agency approvals and permitting required for the project.

- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers
- Environmental Protection Agency
- Bureau of Reclamation
- Utah Department of Water Resources
- Utah Division of Forestry, Fire and State Lands
- Utah Division of Wildlife Resources
- Utah Department of Environmental Quality
- Emery County
- Grand County
- City of Green River

1.3. Existing Conditions

The Green River Diversion is located on the Green River approximately 6 miles upstream of the town of Green River, Utah. The Green River watershed is nested within the Colorado River watershed, which serves about 27 million people and irrigates nearly 4 million acres of land across several states of the Western United States (Gerner et al. 2006) (Figure 1-2). Surface waters of the Green River originate across a 40,500 square-mile basin that includes parts of Wyoming, Utah, and Colorado.

The diversion (Pictures 1-1 and 1-2) is adjacent to the Tusher Wash and is often referred to as the Tusher Diversion. The diversion structure spans the 750-foot width of the river and diverts water to water right holders (irrigators and hydropower users) on both sides of the river. The diversion consists of four features: the main diversion structure, the West Side Raceway, the East Side Canal, and the water wheel (Figures 1-3 and 1-4).



Watershed Area = 40,500 mi²

Figure 1-2: Green River Watershed NRCS Green River Diversion Rehabilitation Final EIS

NOTES:
Points, lines and polygons supplied by various state and federal sources,
including BLM, UDOT, and USGS. Watershed boundary approximated using
the USGS StreamStats program.

McMILLEN, LLC
DESIGN with Vision. BUILD with Integrity.



Legend

- Rivers
- Watershed Boundary
- Freeways
- Major Lakes
- National Parks
- National Forests
- Counties
- States

0 25 50 100 Miles



Picture 1-1. East End of Diversion



Picture 1-2. West End of Diversion



Picture 1-3. Example of Damaged Area

Prior to damage (Picture 1-3) caused in recent spring runoff and storms, the water users identified a number of deficiencies with the diversion including structure and water control gate deterioration, sediment loading, inability to meet water right diversions, flooding, and limitations to recreation. The existing structure has suffered severe damage from recent flooding above and beyond what was identified prior to the 2011 flood event. This recent damage has brought forth concerns regarding the ability of the structure to withstand another flood event similar to the 2011 flood.

The Green River in the vicinity of the diversion is also used by boating recreationists. However, the existing structure does not allow safe downstream boat passage during low flows, as numerous members of the boating public commented during the public scoping period.

1.3.1. Irrigation System

The existing diversion structure is located immediately upstream of Tusher Wash and delivers surface water for three uses (Figure 1-3, Pictures 1-1 and 1-2): the Green River and Thayn Canals, the Thayn Hydropower Plant, and the East Side Canal. The diversion is designed to raise the water surface elevation and provide water to irrigation facilities on both sides of the river.

1.3.1.1. Historic Hastings Ranch, Water Wheel

The water wheel located at the east side of the diversion (Picture 1-4; Figure 1-4) is privately owned by the Hastings Ranch. The structure is a 28-foot welded steel wheel located near the location of the original

wood wheel. This site has been in service since the 1940s, and provides water for irrigation on approximately 60 acres of cropland. The water wheel is not currently delivering water to cropland.



Picture 1-4. Water Wheel at Hastings Ranch, East Bank

(foreground: existing steel wheel; background: original wood wheel)

1.3.1.2. East Side

At the east side of the diversion (Pictures 1-1 and 1-5), water rights are allocated to the East Side Canal Company and the Hastings Ranch water wheel (noted in previous section; Figure 1-4). The East Side Canal receives water from an inlet upstream of the diversion, through a siphon system that passes water under Tusher Wash, and then into a canal that transports water to the south. The east side of the diversion likely provides some fish passage over an existing break on the east side. However, this fish passage was damaged during the 2011 flood event and there is currently about a 2-foot drop during low flows in the Green River, rendering it likely ineffective as a fish passage except during the highest flows.



Picture 1-5. East Side Fish Passage

1.3.1.3. West Side

On the west side of the river, diverted water travels through 8 side-by-side headgates (Figure 1-4) and down the canal (raceway) approximately 0.4 miles to the entrance of the Green River and Thayn Canals and the Thayn Powerhouse (Pictures 1-1, 1-6 and 1-7). The existing “8-Gate” structure is substandard and does not allow for crossing of the raceway, which impedes the operation and maintenance process at the diversion.



Picture 1-6. West End of Diversion



Picture 1-7. West Side Raceway Headgate Structure

1.3.1.4. Sediment Reduction

The existing sluice gate (Picture 1-8) is located on the west side of the diversion structure. The sluice gate is a slide-type gate which is difficult to operate to sluice the sediment through the structure due to the damaged concrete.



Picture 1-8. West Side Sluice Gate

1.3.2. Tusher Wash

A large amount of sediment has been deposited at the point where the Tusher Wash meets the Green River (Picture 1-9), downstream of the diversion structure (Figure 1-4). The wash is a 25-foot wide ephemeral drainage which is dry most of the season and used most often as an access road.



Picture 1-9. Tusher Wash Entrance into the Green River

1.3.3. Hydropower Plant

The Thayn Hydropower Plant is located on the west side of the river, where diverted water travels through the 8 side-by-side headgates and down the West Side Raceway approximately 0.4 miles (Figure 1-3). The majority of the flow in the raceway is delivered to the Thayn Hydropower Plant which passes the water back into the Green River. The remainder of the water is delivered to two irrigation canals (Green River Canal and Thayn Canal/42-Foot Ditch).

The Upper Colorado River Endangered Fish Recovery Program, through funding from the Bureau of Reclamation (BOR) and technical oversight from the U.S. Fish and Wildlife Service (USFWS), is currently evaluating the possible use of a fish return system downstream of the hydropower plant. Further detail on this future project located in the immediate vicinity is provided in Section 3.5.

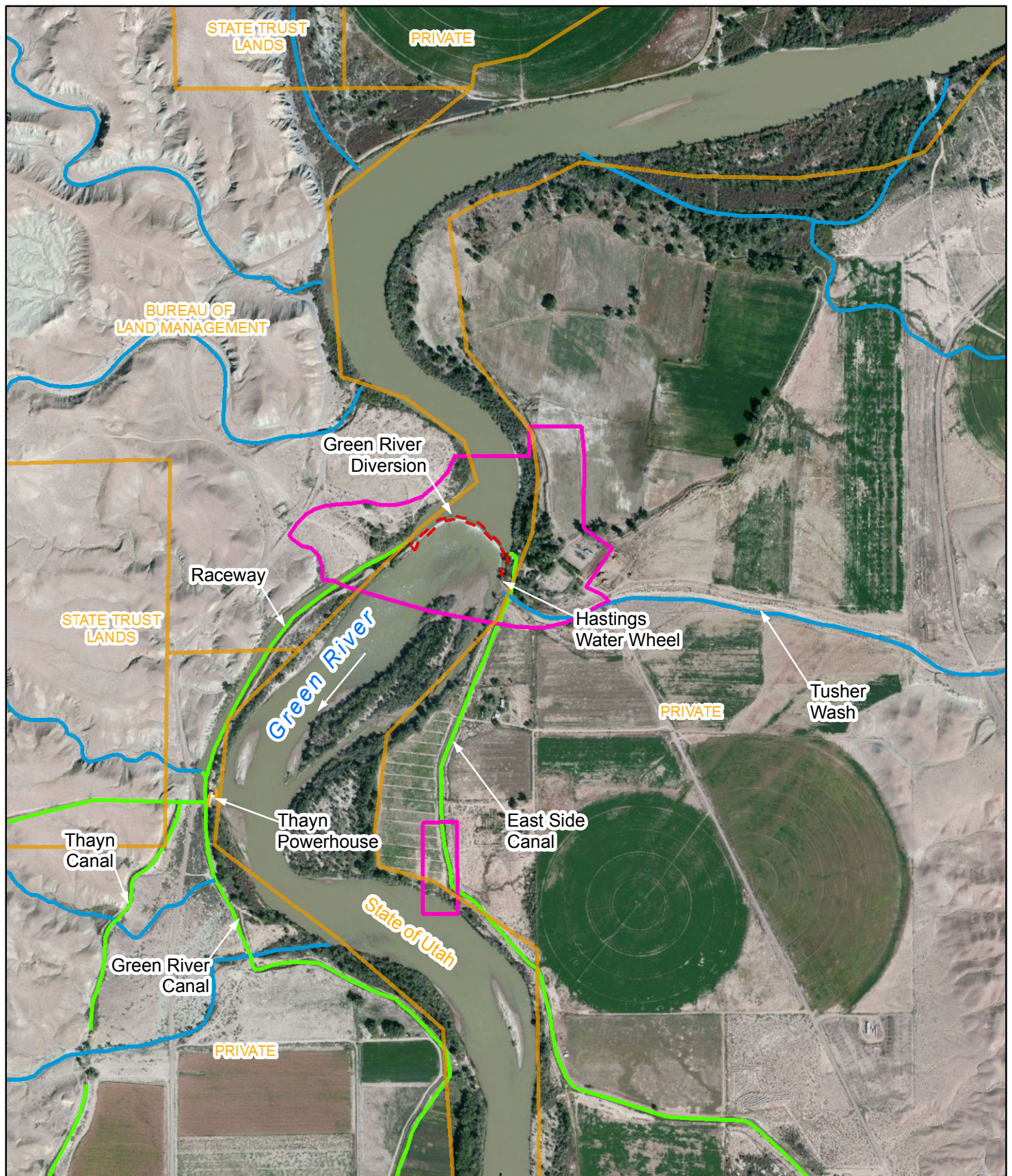


Figure 1-3: Project Area Map
 NRCS Green River Diversion Rehabilitation
 Final EIS

0 500 1,000 2,000 Feet



McMILLEN, LLC
 DESIGN with Vision. BUILD with Integrity.

Legend

- Landowner Boundary
- Thayn Powerhouse
- Green River Diversion Dam
- Project Area
- Stream
- Canal

NOTES:
 Aerial photo from Bing imagery service. Capture date September 2010. Points, lines and polygons supplied by various state and federal sources, including BLM, UDOT, and USGS.

1.4. Project Scope

The NRCS Utah State Office announced its intent to prepare an EIS for the Green River Diversion Rehabilitation Project in May 2013.

This EIS is being prepared by the NRCS to comply with the requirements of the National Environmental Policy Act of 1969 (NEPA) and its implementing regulations. The format of this document follows the outline required for NEPA documents (NRCS 2010b and 2011).

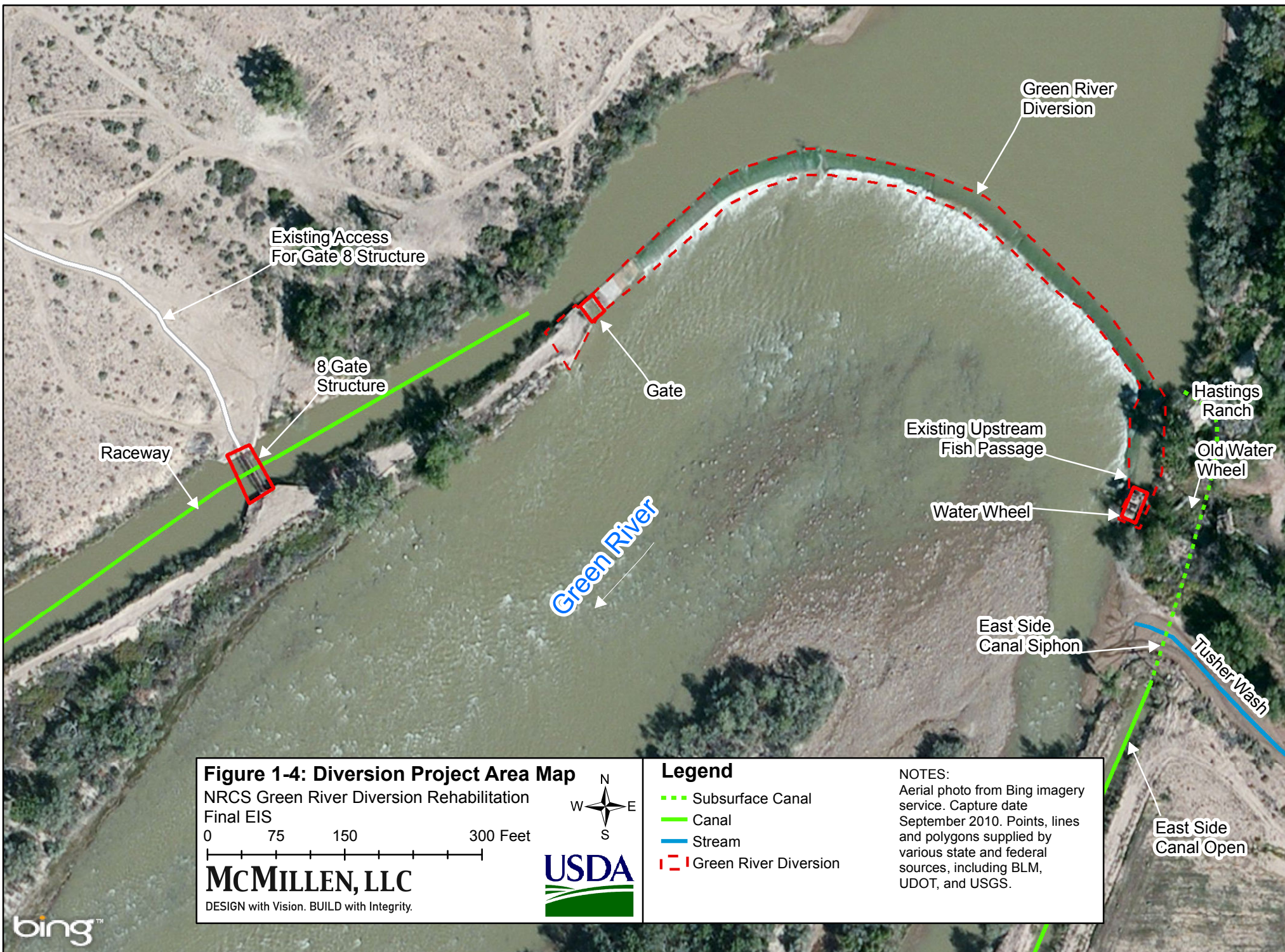
1.4.1. Project Scoping Efforts and History

Agency and stakeholder participation, along with public involvement, are key components that lead the NEPA process. Project information was made available to the public during the first scoping period from October 30, 2012 to November 30, 2012. A public scoping meeting was held on November 15, 2012 at the Green River City Hall. Numerous meetings with agency officials and stakeholders occurred during that time period. Based on the results of these scoping efforts, an Environmental Assessment (EA) was determined to be the correct course of action for the project.

Consultation with the Utah State Historic Preservation Office (SHPO) resulted in a determination that the diversion is historic and may be eligible for listing on the National Register of Historic Places (NRHP). Consequently, any modifications to the diversion may result in an adverse effect to the historic resource. This study has included a wide range of alternatives (as detailed in Chapter 3, Alternatives), some of which would result in impacts to the diversion considered “significant” to cultural resources.

Due to the potential for a significant resource impact, NRCS decided to prepare an EIS for the project instead of an EA. The Notice of Intent (NOI) to prepare an EIS was published, and a second scoping period was opened from May 29, 2013 to July 2, 2013. The EIS complies with the CEQ regulations, which require an evaluation of potential environmental impacts associated with federal projects and actions:

The NRCS State Conservationist must prepare an EIS when the action will result in significant adverse impacts that cannot be mitigated, even if on balance the action will have a beneficial effect. The NRCS State Conservationist must exercise discretion in determining the appropriate level of documentation when there are significant positive impacts, recognizing that it may be advisable to prepare an EIS in certain situations, such as when there is controversy regarding environmental effects. (NRCS 2010b)



1.5. Purpose and Need

1.5.1. Purpose of the Proposed Action

The purpose of the proposed action is to rehabilitate the existing Green River Diversion. The project will rehabilitate the diversion due to damage caused by past flood events, upgrade the diversion infrastructure to current design standards, maintain the level of water delivery to the existing water rights holders, and comply with applicable Federal rules and regulations.

1.5.2. Need for the Proposed Action

The need for the project is to maintain existing functions of the diversion for water delivery to water rights holders (irrigation canals and the powerhouse).

1.5.3. Laws, Regulations, Policies and Determinations

Table 1-2 summarizes the laws, regulations, and policies that could apply to the proposed action and the determinations that NRCS and other agencies might need to make in order to implement the proposed action. These laws, regulations, and policies are in addition to the EWP Program requirements.

Table 1-1. Laws, Regulations and Agency Responsibilities

Law, Regulation, or Policy	Issuing /Approving Agency	Determination	Responsibilities, Concurrences and Timing
Federal Laws, Regulations, and Policies			
BLM Regulation 43 CFR Part 10010 Subparts A through G. sections 10010.1 through 10010.62	BLM	Easements and Land Acquisitions; modification of existing rights-of-way; temporary construction permitting.	UDAF or contractors, with NRCS concurrence; complete all permitting and acquisition before construction begins.
Clean Water Act (33 USC 1251 and subsequent sections), Section 401 ^a	UDEQ-DWQ	Water quality certification; required only if the action is subject to authorization under CWA Section 404.	CWA Section 404 permittee (UDAF or contractors, with NRCS concurrence); receive certification before construction begins.
Clean Water Act, Section 402 (National Pollutant Discharge Elimination System) ^a	UDEQ-DWQ	Compliance with the State's general permit for construction-related stormwater discharges. • Small Municipal Separate Storm Sewer System (MS4) general permits issued to municipalities.	CWA Section 402 permittee (UDAF or contractors, with NRCS concurrence); demonstrate compliance before construction begins.
Clean Water Act, Section 404	USACE	Authorization for the discharge of fill material to waters of the United States; depending on the magnitude of impact, project activity might be authorized under either an existing General (Nationwide) Permit or a new Standard (Individual) Permit.	CWA Section 404 permittee (UDAF or contractors, with NRCS concurrence); receive authorization before construction begins.
Executive Order 11990: Protection of Wetlands	NRCS	Compliance with the Executive Order.	Federal lead (NRCS) and cooperating (BLM) agency; considered during the EIS process.
Executive Order 11988: Floodplain Management	NRCS	Compliance with the Executive Order.	Federal lead (NRCS) and cooperating (BLM) agency; considered during the EIS process.

Law, Regulation, or Policy	Issuing /Approving Agency	Determination	Responsibilities, Concurrences and Timing
Farmland Protection Policy Act (7 USC 4201)	NRCS	Compliance with the Act.	Federal lead (NRCS) and cooperating (BLM) agency; considered during the EIS process.
Fish and Wildlife Coordination Act (16 USC 661 and subsequent sections)	USFWS and UDWR	Compliance with the Act; applies to activity that would modify the Green River. Consultation and coordination as part of the EIS process.	Federal lead (NRCS) and cooperating (BLM) agency; considered during the EIS process.
Endangered Species Act (16 USC 1531 and subsequent sections)	USFWS	Consultation under Section 7 of the Act to determine the project's potential to affect listed species. Consultation as part of the EIS process.	Federal lead (NRCS) and cooperating (BLM) agency; considered during the EIS process.
Migratory Bird Treaty Act (16 USC 703 and subsequent sections)	USFWS	Compliance with the Act.	Federal lead (NRCS) and cooperating (BLM) agency; considered during the EIS process. UDAF or sponsor's contractor monitors compliance during construction, if necessary.
Bald and Golden Eagle Protection Act (16 USC 668)	U.S. Department of the Interior (DOI), usually USFWS	Compliance with the Act.	Federal lead (NRCS) and cooperating (BLM) agency; considered during the EIS process. UDAF or sponsor's contractor monitors compliance during construction, if necessary.
Executive Order 13112: Invasive Species	NRCS	Compliance with the Executive Order.	Federal lead (NRCS) and cooperating (BLM) agency; considered during the EIS process.
National Historic Preservation Act ^a (16 USC 470)	Utah SHPO; and ACHP	Consultation under Section 106 of the Act to determine the project's potential to affect listed or eligible resources.	Federal lead (NRCS) and cooperating (BLM) agency; consultation during the EIS process.
Executive Order 12898: Environmental Justice for Low-Income and Minority Populations	NRCS	Compliance with the Executive Order.	Federal lead (NRCS) and cooperating (BLM) agency; considered during the EIS process.
Utah Laws, Regulations, and Policies			
Water Rights	UDWR _t	Consistency with permitted water rights.	NRCS considers during EIS process; ultimately the responsibility of the permittee.
Sovereign Lands (Utah Admin Code 65A-1-2 and 65A-10-1)	FFSL	Compliance with State code. Special Use Lease required. Sovereign lands are managed under the Public Trust Doctrine using multiple use/sustained yield principles and must ensure that all uses on sovereign lands are regulated such that protection of navigation, fish and wildlife habitat, public recreation, and water quality are balanced against the economic necessity or benefit to be derived from any proposed use.	NRCS considers during EIS process; ultimately the responsibility of the permittee.
Stream Alteration	UDWR _t	Compliance with State code.	NRCS considers during EIS

Law, Regulation, or Policy	Issuing /Approving Agency	Determination	Responsibilities, Concurrences and Timing
			process; ultimately the responsibility of the permittee or its contractor.
Antidegradation (Water Quality)	UDEQ-DWQ	Compliance with State code for maintenance of high-quality waters; requires separate review.	NRCS considers during EIS process; ultimately the responsibility of UDAF or permittee.
Drinking Water Source Protection	UDEQ-DWQ	Compliance with State code.	NRCS considers during EIS process; ultimately the responsibility of UDAF, the permittee, or its contractor.
Utah Air Quality Rules	UDAQ	Compliance with applicable rules for construction activity.	NRCS considers during EIS process; ultimately the responsibility of UDAF, the permittee, or its contractor.

^aFederal law for which implementation has been partially or wholly delegated to the State. Note: see Acronyms and Abbreviations for all short forms listed.

1.5.4. Resources Studied In Detail

Table 1-3 lists the resource considerations that were determined to be relevant to the decisions that must be made concerning the project and require further analysis in this EIS. These resources were selected by internal project coordination and through public scoping.

Table 1-2. Resources Studied in Detail

Resource Category	Specific Resources Studied	Resource Category	Specific Resources Studied
SOIL	Streambank Erosion Prime and Unique Farmlands Geology	PLANTS	Endangered and Threatened Species Invasives Riparian Areas
WATER	Surface Water Quality, Sedimentation Hydrology, Water Rights Groundwater, Floodplains Waters of the US/Wetlands Climate Change	ANIMALS	Endangered and Threatened Species Invasives Fish and Wildlife Habitat
		HUMANS	Cultural Resources Hazardous Toxic/Radiologic Wastes Recreation, Wild and Scenic Rivers Public Health and Safety Visual/Aesthetics/Scenic Beauty Land Use, Infrastructure, Noise
AIR	Air Quality		

1.5.5. Resources Eliminated From Further Study

As directed by CEQ regulations 1500.1(b), 1500.2(b) and other sections, the NRCS eliminated the following resource considerations from detailed study because the proposed action would cause only inconsequential or no effect to occur to these issues. In accordance with NRCS policy, a Damage Survey Report (Appendix C) was completed for the proposed project that documented the general environmental conditions at the project site. Other than the information presented in Table 1-4 below, the EIS contains no further information on these eliminated resource issues.

Table 1-3. Resources Eliminated from Further Study

Resource Category	Specific Resources Eliminated	Resource Category	Specific Resources Eliminated
SOIL	Upland Erosion	PLANTS AND ANIMALS	Natural Areas Essential Fish Habitat Coral Reefs
WATER	Regional Water Management Plans Coastal Zone Management Areas	HUMANS	Parklands

CHAPTER 2. AFFECTED ENVIRONMENT

The purpose of this chapter is to describe the area that could be affected by the proposed alternatives, including the areas of ecological, cultural, social, aesthetic, and economic resources affected by the proposed action. The purpose of describing the affected environment is to define the context in which the impacts could occur.

In the following sections of this report the *project area and/or vicinity* is defined as the resources that occur within ½ mile to one mile of the Green River Diversion. The term *study area* is often much larger, typically county wide to ensure that all resources are accounted for during project research. The *project site* is synonymous with *project footprint* and only includes the area that would be disturbed during construction.

2.1. Soil Resources

Soil information presented in this section has been summarized from NRCS Web Soil Survey data (NRCS 2013a). Soils in the study area (Figure 2-1) have been mostly derived from the Mancos Shale. In the study area portion of Grand County, two soil types are prevalent, including the Redbank-Flatnose families association, and the Toddler-Ravola-Glenton families association. Emery County soils in the area include Beebe loamy fine sand, Ferron-Green River-Rafael complex, Garley-Ravola-Huntsman complex, Hunting loam, strongly saline, Penner loam, and Vickel-Utaline-Persayo complex. The dominant soils within the study area are characteristic of river valleys and floodplains and occur at elevations comparable to the diversion and surrounding area. These soils are briefly described in Table 2-1.

Table 2-1. NRCS Web Soil Survey Data

Name	Landform	Ecological Site	Slope (%)	Comment
Redbank-Flatnose Association	Flood plains	Greasewood and/or Coyote Willow	0 to 3	Comprised of nonsaline, porous fine sandy to gravelly loams. Occurs adjacent to the east bank of the river from 4,000 to 6,500 feet elevation.
Toddler-Ravola-Glenton Families Association	Drainageways, flood plains	Castle Valley Saltbush	0 to 3	Comprised of well-drained, nonsaline to slightly saline, silt loams and fine sandy loams.
Ferron-Green River-Rafael Complex	Flood plains	Inland Saltgrass and Fremont Cottonwood	1 to 2	Comprised of poorly drained, nonsaline to moderately saline, very fine to fine sandy loams.
Garley-Ravola-Huntsman Complex	Flood-plain Steps	Big Basin Sage, Shadscale, and/or Black Greasewood	1 to 4	Comprised of well-drained, very slightly saline to moderately saline, clay, fine sandy, gravelly sandy clay, and gravelly fine sandy loams.
Vickel-Utaline-Persayo Complex	Pediments	Shadscale, Indian Ricegrass, and/or Mat Saltbush	8 to 45	Comprised of well-drained, nonsaline to slightly saline, gravelly or clay loams that occur between 4,000 and 6,400 feet elevation.

Soil borings completed during preparation of a recent design report provided soil data from the surface to as deep as 54.5 feet at sites on and around the diversion (Alpha Engineering Company 2010). Data confirmed that soils are a mixture of silty sand, sand with silt and gravel, and loose gravel with silt and sand. Some areas have sandstone boulders and cobbles in a silty sand matrix.

2.1.1. Geology

The Emery County General Plan describes the geology of the area:

Emery County is located 'where the desert meets the mountains,' at the border of the Colorado Plateau and the High Plateaus. On the western side of the County is the Wasatch Plateau, which is the major water source for the County. The San Rafael Swell dominates the County's center with its rugged reefs, 'castles' and gorges. East of the San Rafael Swell is the Green River Desert, an arid district which has been historically important to ranching operations located in the lower San Rafael Valley. The eastern border of the County is formed by the Green River. (Emery County 2008)

The geology of the area of consideration is comprised of Quaternary alluvium and colluvium, with areas of older alluvium, and Mancos Shale (Hintze et al. 2000). The Green River floodplain is largely comprised of Quaternary alluvium deposits of sands and gravels, while the Mancos Shale dominates the area immediately surrounding the diversion. The Mancos Shale was deposited approximately 95 to 80 million years ago during the Cretaceous period, when an inland sea covered much of the western interior of the country. Deposition in this marine environment resulted in the accumulation of alkali salts that result in moderate to high concentrations of dissolved minerals and salts in local groundwater.

Topography within and around the study area ranges from 4,079 feet at the diversion's crest elevation, to approximately 4,190 feet at a high point to the west of the river (Blue Castle Butte Quadrangle). Landslide hazards are generally of very low to low potential in the study area according the Utah Geological Survey (2007). Moderate landslide potential does occur upstream and downstream of the diversion west of the river in small areas. These areas are associated with the extreme slopes of buttes within the Beckwith Plateau. There are no nearby areas of high landslide potential.

A recent reconnaissance of geologic hazards did not reveal any evidence of active faults, landslides, or rockfalls in the study area (Alpha Engineering Company 2010). Seismic hazards are considered relatively low. The most significant hazards at the site are high water flows associated with extreme storm events.

2.1.2. Stream Bank Erosion

Soil erosion has been noted as a common problem for Emery and Grand Counties (UACD 2011, 2012). As noted above, local soils are primarily derived from Mancos Shale. These soils are highly erosive and have inconsistent shrink/swell properties (UACD 2012). Runoff from intense summer rainfall events over barren slopes can produce flash floods in the dry washes and canyon bottoms of this region. These floods increase sediment deposition and loading in streams, ultimately causing water quality and flood storage capacity issues.

These natural erosional forces are accelerated by alteration of soils through changes in stream geomorphology, development of adjacent lands, and use of adjacent lands for agriculture or grazing. The construction of the diversion resulted in changes to the natural flow regime and sediment transport in the Green River. Sediments in the river now become trapped behind the diversion and enter the raceway and ditch. The trapping of sediments behind the diversion can cause erosion downstream of the diversion or along the riverbanks.

Stream bank erosion occurs naturally but increases when vegetation is removed from the banks. Some areas of the bank around the diversion have minimal riparian vegetation and human disturbance that can contribute to erosion.

2.1.3. Sedimentation

The Green River carries a high suspended sediment load and is experiencing sediment deposition at several locations along the Green River Canal. These alluvial deposits include silty sand, gravel, cobbles, and occasional boulders (Alpha Engineering Company 2010). The physical removal of the sediment is very costly (UWRL 2010) and irrigators are interested in ways to minimize the transport and deposition of sediment in the canal.

A study being conducted by the Utah Water Research Laboratory (UWRL) for the Green River Canal Company (GRCC) is currently underway regarding sediment found in the canal as a result of the sedimentation process. The study has multiple objectives, including establishment of a grain size distribution, classification of the types of soils present, and determination of the minimum velocity required to maintain suspension of the silt particles entering the irrigation canal. A second objective is to create an accurate map of the Green River irrigation canal including the location of all turnouts, returns, and check gates to aid the GRCC in locating, governing, and maintaining the irrigation structures in its system. The third objective is to create a spreadsheet accounting model that describes the operating conditions of the canal and allows canal operators to minimize sedimentation by identifying potential problem areas. The fourth objective is to provide the GRCC with a set of operational guidelines for the Green River irrigation canal, which also describes how the Green River canal model functions. The final objective is to provide the GRCC with recommendations for canal operation in order to limit sedimentation. Research on the canal will continue until the objectives are met (UWRL 2010), and coordination will continue with the UWRL to incorporate results within the design of the Green River Diversion Rehabilitation.

2.1.4. Prime and Unique Farmlands

Prime and unique farmland is a designation for areas that support the growth of specific high-value food and fiber crops and are considered of national importance. There are no prime or unique farmlands within the project area, though an area of prime farmland does occur to the south of the project area. Farmland of statewide importance, however, exists immediately adjacent to the river.

Farmland of statewide importance is identified by state agencies as important for agricultural use in the state, but is not of national significance. This land must be irrigated to receive this designation. On the east bank, immediately upstream and downstream of the diversion, farmland of statewide importance is present where Redbank-Flatnose soils (047, as depicted on Figure 2-1) occur, agricultural uses are present, and irrigation is adequate (NRCS 2013a, UACD 2011).

Prime farmland south of the project area occurs where Penner Loam soils are present (NRCS 2013a). This soil is only considered prime if it is adequately irrigated and if soil erodibility and climate meet established criteria.

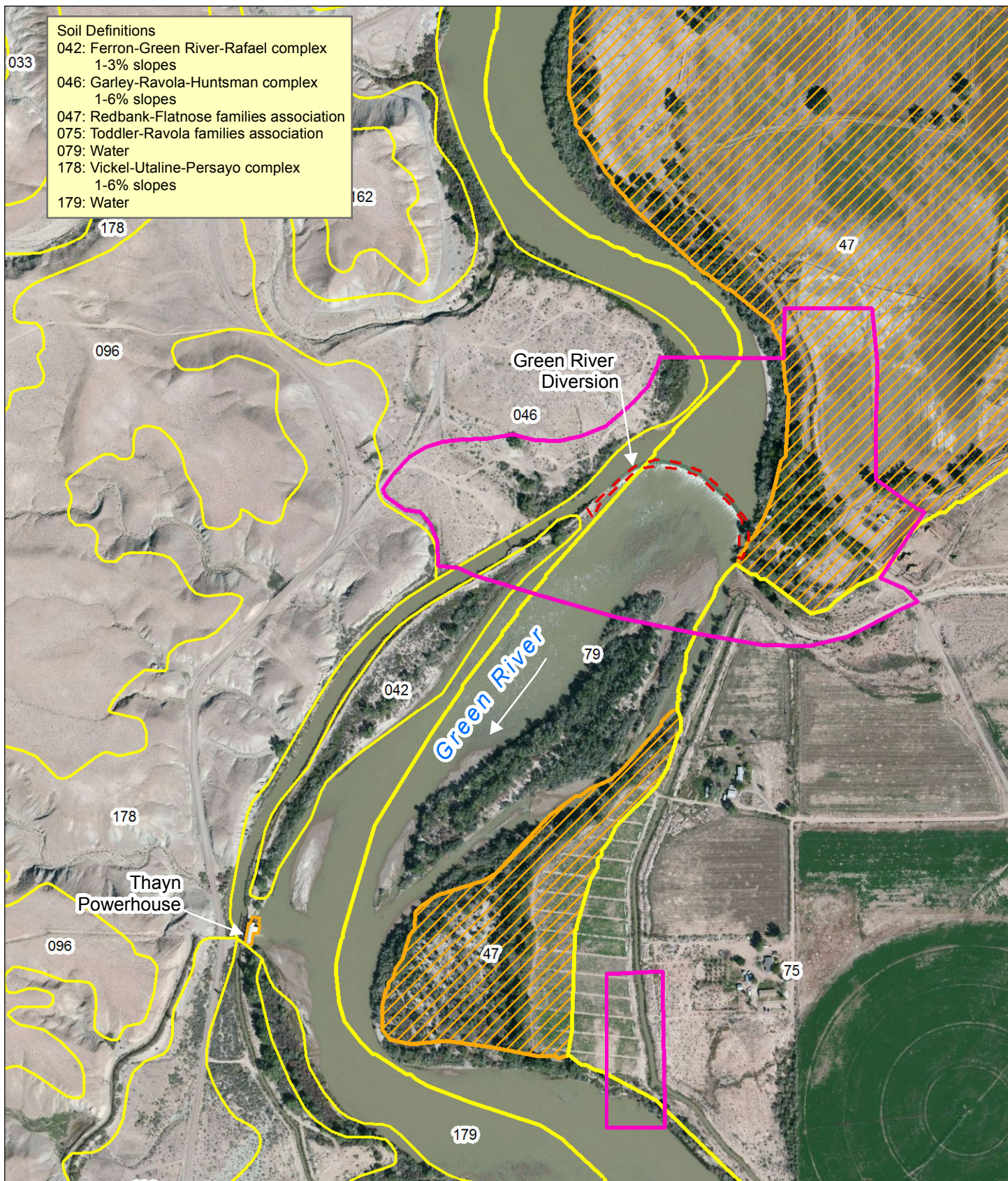


Figure 2-1: Soil - Prime & Unique Farmland

NRCS Green River Diversion Rehabilitation Final EIS

0 300 600 1,200 Feet

McMILLEN, LLC



Legend

- Green River Diversion Dam
- Project Area
- Project Area Soils
- Farmland of Statewide Importance
- Thayne Powerhouse

NOTES:
Aerial photo from Bing online map service. Capture date September 2010. Soils from NRCS data mart; soils outside of project area excluded.

2.2. Water Resources

The Green River in Utah from the confluence with the Colorado River to the state line is designated for the following beneficial uses: 1) domestic water supply (with appropriate treatment); 2) primary contact recreation; 3) protection of warmwater species and aquatic life; and 4) agricultural uses (State of Utah 2013). This segment of the Green River in the project area is not listed on the State of Utah's 303(d) list of impaired water bodies and meets most beneficial uses. Currently, it is listed as achieving all beneficial uses except primary contact recreation, but does achieve infrequent contact recreation (Utah Division of Water Quality 2013).

Also protected for secondary contact recreation where there is a "low likelihood of ingestion of water or a low degree of bodily contact with the water. Examples include, but are not limited to, wading, hunting and fishing" (UAC 2013).

2.2.1. Water Quality

In 2004-2005, the U.S. Geological Survey (USGS) conducted an investigation of water quality in the Green River within the reach just upstream of the Green River Diversion down to the city of Green River. The study looked at specific dissolved solids concentrations, which were observed in wide ranges within the reach. Waters diverted for irrigation typically had much lower concentrations, while drainage water from agricultural runoff returning to the river had much higher concentrations (Gerner et al. 2006). Despite the local high concentrations of suspended sediment, no Total Maximum Daily Load (TMDL) rules exist for the reach. Finally, a uranium mill tailings disposal site is located approximately 8 miles downstream of the project site. The most recent evaluation of the disposal facility concluded that no constituents of concern (arsenic, nitrate + nitrite, selenium, sulfate, or uranium) had exceeded their respective proposed alternate concentration limits at sampling locations within the Green River (DOE 2012).

Water temperature in the Green River near the city of Green River was periodically recorded between 1952 and 1981. Although there is variation throughout, the completion of Flaming Gorge Dam in the late 1960s has dampened this variation, leading to a more uniform inter-annual average temperature. Overall, the average annual temperature in the Green River is about 13.9 °C (57.0 °F). Also, the presence of the dam appears to have led to an overall drop in average water temperature, most likely due to the thermal stratification in the reservoir and the initial bottom release of water, despite the fact that water is now released at multiple levels from within the reservoir.

The State of Utah's Administrative Code (UAC) section 19-5-110 requires the waters of the state be grouped into classes in order to protect against controllable pollution impacting the designated beneficial uses (UAC 2013). The segment of the Green River that is located within the project area has been designated as Class 2B which is defined by the UAC section R317-2-6 as "Protected for infrequent primary contact" (UAC 2013).

2.2.2. Hydrology

The watershed drainage area upstream of the Green River Diversion is approximately 40,500 square miles (Figure 1-2). The Green River Watershed is nested within the Colorado River Watershed, which serves about 27 million people and irrigates nearly 4 million acres of land across several states of the Western United States (Gerner et al. 2006). Surface waters of the Green River originate across the basin which includes parts of Wyoming, Utah, and Colorado. USGS Gaging Station 09315000, located approximately 8 river miles downstream of the diversion near the city of Green River, has a 111-year record of discharge that indicates an average daily flow rate of 6,085 cubic feet per second (cfs). However, flow in the Green River is partially regulated by Flaming Gorge Dam, which is located 407 river miles from the mouth of the Green River.

Flaming Gorge Dam was completed in 1965, after which flows in the Green River were regulated due to water storage in Flaming Gorge Reservoir. Peak discharges above the Green River Diversion were therefore estimated using the HEC-SSP program (USACE 2010) for the years 1965 through 2009. Results are given in Table 2-2 for the 2-, 25-, 50-, and 100-yr events. Results in the table are similar to results published elsewhere (Gerner et al. 2006).

Table 2-2. Peak Discharges For Various Return Periods, Above Green River Diversion

Statistic	Flow (cfs)
2-year	21,386
25-year	40,726
50-year	44,603
100-year	48,170

Flow rates estimated using StreamStats and the HEC-SSP program (Concept Design Report, McMillen 2014)

The Concept Design Report (Appendix B) provides further detail on the hydrology of the Green River in the vicinity of the project. The analysis has concluded that the minimum flow expected at the Green River Diversion structure is 1,132 cfs.

2.2.3. Water Rights

Several water rights exist on the river near the project location. Some of these rights are approved, while others have been perfected. A perfected water right is a right that has been both approved, and consummated, i.e. the water right has actually been put to beneficial use. A list of the water rights near the project is provided in Table 2-3 and is shown in Figure 2-2.

Table 2-3. Water Rights for Study Area

Map Location	Water Right ID	Owner	cfs	ac-ft	Use	Point of Diversion
1	91-5059	D.Carter		16	I	Unidentified
	91-294	Green River Canal Co	60	5888.2	I, S, D	Unidentified
	91-5043	Green River Canal Co	20		R	Tusher Dam

Map Location	Water Right ID	Owner	cfs	ac-ft	Use	Point of Diversion
	91-39	Green River City	220		H	Below Diversion; Inactive
	91-5075	Gunnison Butte Mutual Irr. Co.	4	2879.7792	I	Tusher Dam
	91-113	L. Thayn	35		I	Unidentified
	91-4130	L. Thayn	600		H	Raceway
	91-5161	L. Thayn	4	3153	I	Tusher Dam
2	92-43	C.Dunham, H.Hastings, C.Ross	60		H	Unidentified
	92-74	C.Dunham, H.Hastings, C.Ross	5		I	Unidentified
	92-620	Sequoiadendron, LLC		2.71	I, S	Unidentified
3	92-657	JD Banasky		801.5946	I	East Side Canal
	92-661	G.Clark or E.Clark		32.82	I	East Side Canal
	92-656	C.Dunham		521.82	I	East Side Canal
	92-667	C.Dunham		68.34	I	East Side Canal
	92-660	K. and P. Dunham		86.64	I	East Side Canal
	92-659	N. Dunham		522.6	I	East Side Canal
	92-658	H. Nelson		37.26	I	East Side Canal
4	92-633	Eastside High Ditch Irr. Co.	7	4900	I	Unidentified
	92-4	East Side Irr. Co.	6		I	Unidentified
	92-638	Gunnison Butte Mutual Irr. Co.	11	8238.9054	I	Eastside Diversion
	92-69	TJ Hastings	1		I	Unidentified
	92-21	B. and D. Nelson	2		I	Unidentified
	92-646	SITLA		526.12	I	Unidentified
	92-645	SITLA		51.88	I	Unidentified
5	92-622	Eastside High Ditch Irr. Co.	5	3480	I	Existing div dam, headgate, canal
Total Active:			819			

ac-ft = acre feet; SITLA = State of Utah School and Institutional Trust Lands Administration

Uses: I = irrigation; S = stockwater; D = domestic; H = hydropower plant; R = raceway

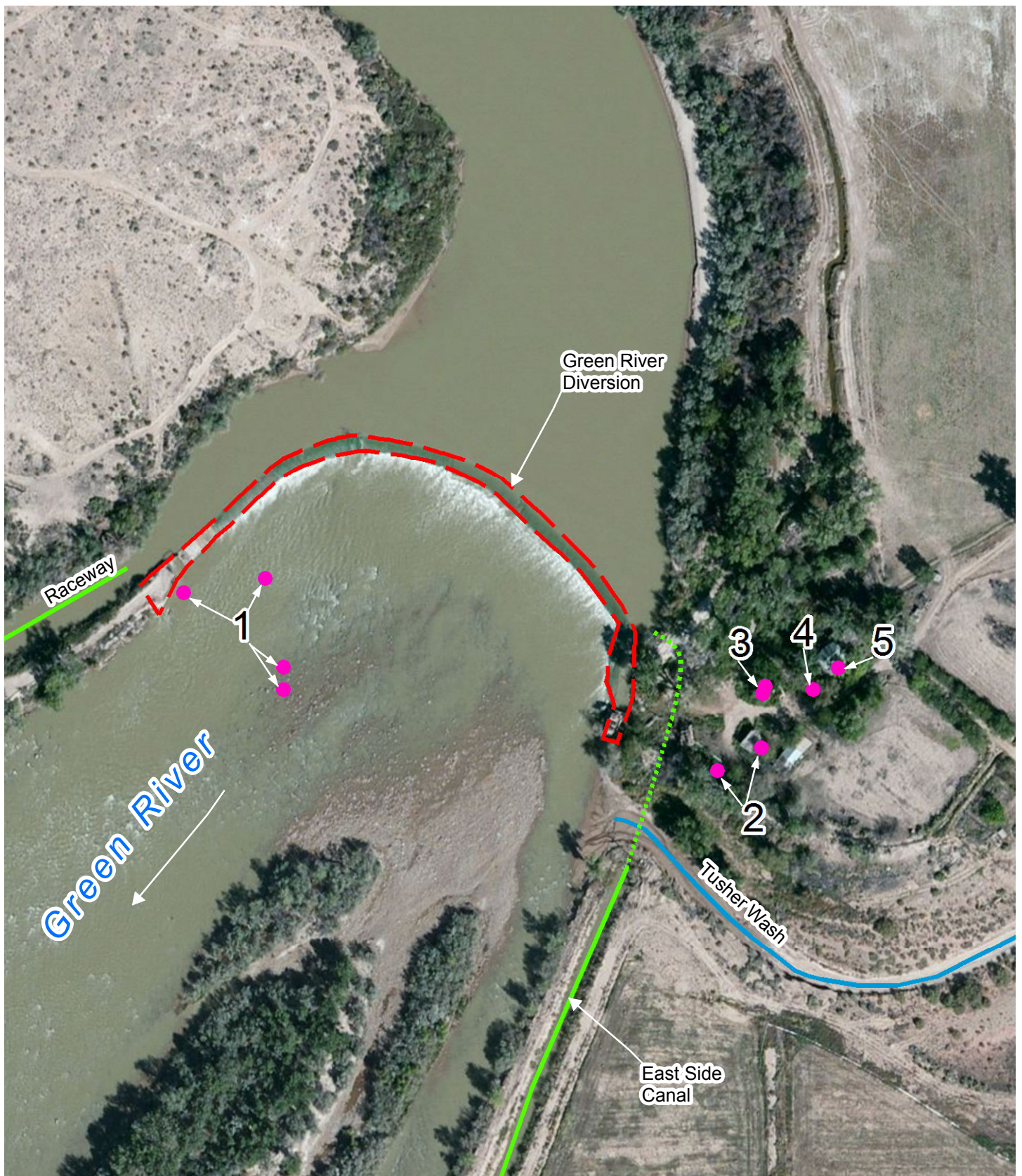


Figure 2-2: Water Resources, Water Rights

NRCS Green River Diversion Rehabilitation
Final EIS

0 100 200 400 Feet

McMILLEN, LLC

DESIGN with Vision. BUILD with Integrity.



Legend

- Water Rights
- Canal
- Stream
- - - Diversion Dam

NOTES:

Aerial photo from Bing imagery service. Imagery captured September 2010. Water Rights diversion data from Utah Division of Water Rights(2013). Stream layer from AGRC, based on National Hydrography Dataset.

2.2.4. Groundwater

USGS conducted a study of groundwater and surface water quality conditions downstream of the diversion in 2004–2005 (USGS 2006). Groundwater in the project area generally occurs in the Mancos Shale from 1 to 15 feet below ground surface and has high dissolved solids concentrations. Groundwater wells in the study area had dissolved solids ranging from 687 to 55,900 mg/L. The transport of salts (dissolved solids) from agricultural irrigation, concentration from evapotranspiration, and weathering of rocks in the soil are likely sources of salts in groundwater. Existing groundwater rights exist within one mile of the project site; a table listing those rights and uses can be found in the Concept Design Report (Appendix B).

2.2.5. Floodplains

The Federal Emergency Management Agency (FEMA) flood insurance map for the study area (Map 4902320016A [historic, dated 1981]) indicates that the 100-year floodplain extends for approximately 200 feet to 1,000 feet in width along the east side of the Green River (Figure 2-3). The west side in the study area is on BLM property and is not mapped.

2.2.6. Waters of the U.S. including Wetlands

The jurisdictional wetland delineation and waters of the U.S. inventory was performed in April 2014. The Waters of the U.S. and Wetland Delineation Report (Appendix C) was prepared and conducted to identify and assess waters of the U.S. and wetlands within or adjacent to the project area. Waters of the U.S. in the project area can be divided into natural drainages and associated wetlands as well as irrigation-related canals, laterals, and drains. Six distinct features (the Green River, Tusher Wash, the East Side Canal, and Wetlands A, B, and C) were delineated as potentially jurisdictional waters of the U.S. or wetlands during the survey. The boundaries of the delineated aquatic features are depicted in Figure 2-3. Within the Project (survey) Area, the OHWM of the Green River was delineated along a total of 3,934 feet, the Tusher Wash OHWM along 881 feet, and the East Side Canal OHWM for 761 feet. A total of 0.18 acres of Palustrine Emergent wetlands were delineated.

2.2.7. Climate - Local

The climate of Utah experiences wide temperature variations between seasons due to its mid-continent location. The climates in Utah also vary greatly depending on the physiologic location and elevation. During winter and spring, temperatures average below freezing and most of the precipitation comes in the form of snow with a deep snowpack accumulating in many of the mountainous high elevations. By late spring, temperatures warm up in the lower valley elevations and the mountain snowpack begins to melt. The high mountain roads and trails are not normally free of snow until mid- to late-June. The summer season brings warm temperatures to most areas in the valleys with hot temperatures in the desert areas. Afternoon thunderstorms become common by June and can be expected into September.

The diversion is located 6 miles northeast of the city of Green River at an approximate elevation of 4,089 feet (above mean sea level). The closest weather station to the diversion structure is at Green River Aviation (Western Regional Climate Center 2012). The area averages a yearly rainfall of 6.45 inches and

an average yearly snowfall of 7.7 inches. The average temperature reaches its maximum in July at 97.7°F and its minimum in January at 38.2°F. On average, there are 255 sunny days per year in the area (City Data 2012).

2.2.8. Climate Change

A recent report by the Southwest Climate Alliance (Cayan et al. 2013) described an evaluation of the potential future conditions in the Southwestern U.S. based on the latest climate change models. The key findings include the following:

- Air temperatures in the Southwest will rise by more than 3° F over the next 100 years (high confidence).
- Temperature rise will occur more in summer and fall than in winter and spring (medium-high confidence).
- Climate variations in temperature and precipitation will continue to be prominent (year to year and decade to decade; high confidence).
- There will be lower precipitation in the southern portion of the Southwest region and little change in the northern portion of the region (medium-low confidence).
- There will be a reduction in mountain snowpack over the next 100 years (high confidence).
- Substantial areas of the region will have reduced runoff and streamflow over the rest of the century (medium-high confidence).

A recent report, prepared by the RAND Corporation for the U.S. Bureau of Reclamation (Groves et al. 2013), investigated the effects of climate change in the Colorado River Basin proper and found the following:

- Air temperature within the entire Colorado River Basin will increase by 2.5 to 4.0 degrees Celsius (4.5-7.2° F) by 2080;
- Runoff due to snowmelt is expected to shift to earlier in the year;
- An overall increase in demand is expected across a variety of uses;
- Precipitation declines of up to 15% are expected over the next 50 years in the Upper Basin;
- A reduction in streamflow of 10 to 20% is expected over the next 50 to 100 years;
- The Upper Basin, including the project reach, has only ever consumed 3.8 million acre-feet (maf) out of its 7.5 maf allocation from the Colorado River Compact of 1922.

The existing demand in the Upper Basin is approximately 51% of the total allocated for consumptive use in the Upper Basin.

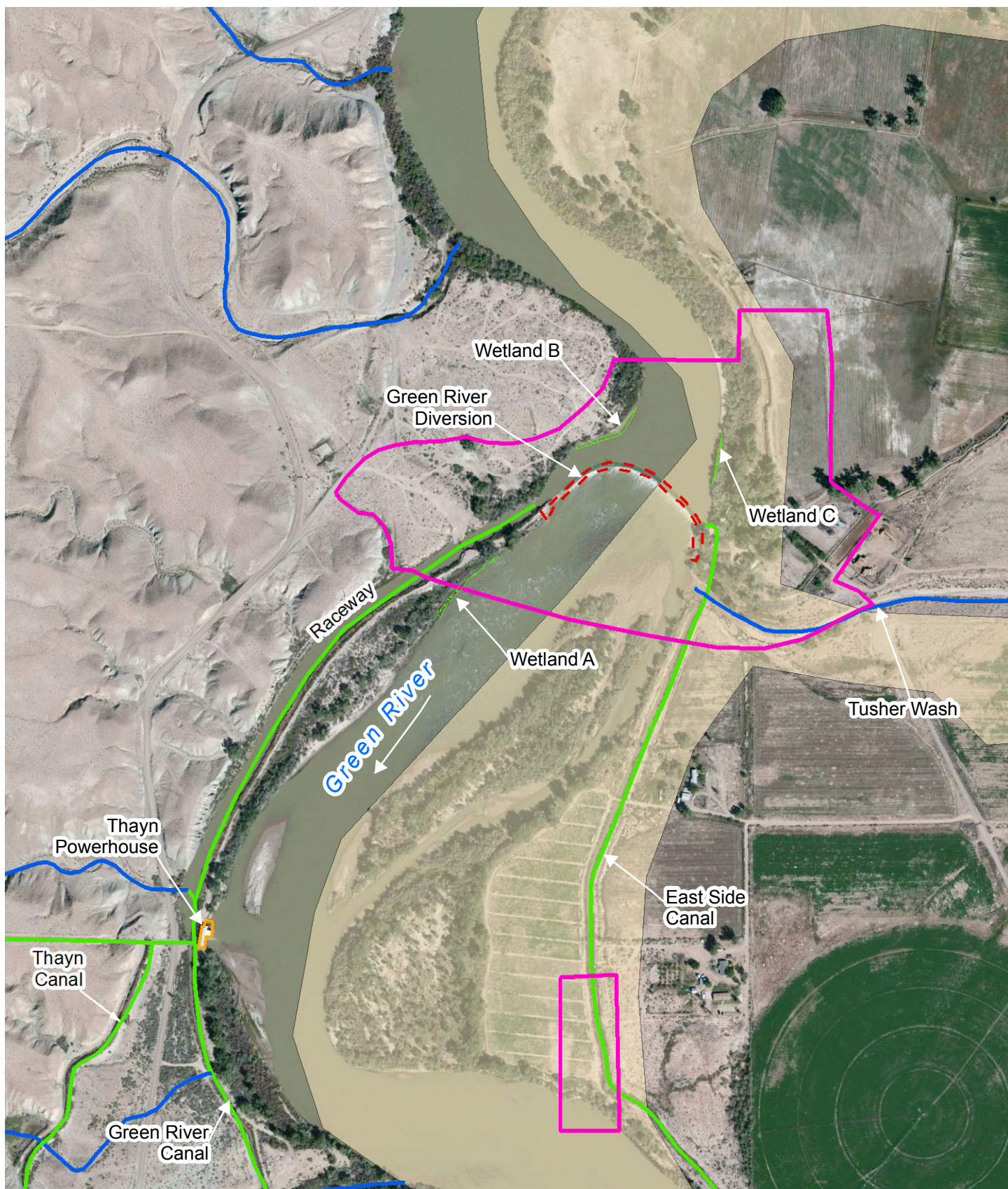


Figure 2-3: Waters of the U.S., Wetlands and Floodplains

NRCS Green River Diversion Rehabilitation Final EIS

0 300 600 1,200 Feet

McMILLEN, LLC
DESIGN with Vision. BUILD with Integrity



Legend

- Delineated Wetlands
- Project Area
- Stream
- Canal
- FEMA Floodplain

NOTES:

Aerial photo from Bing imagery service. Capture date September 2010. Wetland data from delineation data collected in the field by McMillen, LLC. Floodplain data provided by FEMA for Grand County only.

2.3. Air Quality

2.3.1. National Ambient Air Quality Standards

Pursuant to requirements of the Clean Air Act (42 U.S.C. 7401 et seq.), the U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. Monitoring of NAAQS pollutants is conducted in Utah by the Utah Department of Environmental Quality's (UDEQ's) Division of Air Quality (DAQ). The following air quality data are summarized from the 2012 UDEQ air quality report (UDEQ 2012).

NAAQS pollutants include carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), particulate matter (PM), sulfur dioxide (SO₂) and lead (Pb). DAQ has 25 fixed air quality monitoring stations throughout the state of Utah to monitor the NAAQS pollutants. There are no fixed monitoring stations in Emery or Grand counties and the annual report does not include either county in the state nonattainment (exceeds NAAQS) or maintenance areas (historically exceeded NAAQS).

2.3.2. Climate and Greenhouse Gases

Gases that trap heat in the atmosphere are called greenhouse gases (GHG). Data regarding GHGs, regulations, and emissions sources are summarized from EPA (2013). GHGs include CO₂, methane (CH₄), nitrous oxide (N₂O), and fluorinated gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. In Utah, emissions inventories are conducted every 3 years.

The Center for Climate Strategies (CCS) prepared a report for UDEQ to evaluate historic and projected GHG emissions in Utah (2005). The CCS report suggested that activities in Utah accounted for about 1% of the total gross GHG emissions in the U.S for the year 2005. However, Utah's gross GHG emissions were reported to be rising faster than those in the rest of the nation; from 1990 to 2005. The CCS report suggested that current trajectories of GHG emissions would result in a 95% increase in emissions from 1990 to 2020. However, the U.S. Energy Information Administration (2013) recently reported that state energy-related CO₂ emissions in Utah had gone down by 1.3% from 2000 to 2010.

2.4. Plants

2.4.1. Vegetation Communities

Vegetation communities present in the area have been mapped by the Southwest Regional Gap Analysis Project (USGS 2005a). Ten discrete communities occur in the general area and five of those communities are immediately adjacent to the river. Table 2-4 summarizes the communities as described in the analysis (USGS 2005b). The five primary communities present in the study area are presented first.

Table 2-4. GAP Analysis Summary

Vegetation Community	Summary
Colorado Plateau Mixed Bedrock Canyon and Tableland	This vegetation is characterized by very open tree canopy or scattered trees and shrubs with a sparse herbaceous layer. It occurs on the west bank, both upstream and downstream from the diversion
Inter-Mountain Basins Mixed Salt Desert Scrub	This is a widespread ecological system that includes open-canopied shrublands of typically saline basins, alluvial slopes, and plains across the western U.S. It occurs on the west bank, both upstream and downstream of the diversion.
Inter-Mountain Basins Greasewood Flat	This vegetation community typically is found near drainages on stream terraces and flats. It occurs in a small area on the west bank, upstream from the diversion.
Invasive Southwest Riparian Woodland and Shrubland	This invasive plant community dominates the land cover along the east bank of the study area from approximately 2,000 feet upstream of the diversion to 200 feet downstream. It also occurs on the west bank upstream of the diversion.
Developed, Medium - High Intensity	These areas have a mixture of constructed materials and vegetation. Impervious surface accounts for 50 to 100% of the total cover.
Inter-Mountain Basins Mat Saltbrush Shrubland	This ecological system is found on gentle slopes and rolling plains in the northern Colorado Plateau and Uinta Basin on Mancos Shale. It occurs at locations over 300 feet from the west riverbank and beyond.
Colorado Plateau Blackbush-Mormon-Tea Shrubland	This vegetation community is characterized by extensive open shrublands with a sparse herbaceous layer composed of grasses. There are two small communities within a few hundred feet of the west bank of the river.
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	This community is typically found within the flood zone of rivers, on islands, sand or cobble bars, stream banks, and irrigation ditches. Patches of this native riparian habitat are in the study area along the diversion canal.
Invasive Annual and Biennial Forbland	A small area of this community on the west bank, downstream of the southern end of the diversion canal.
Agriculture	Agriculture areas occur well upstream and downstream of the diversion and over 500 feet from the east bank.

2.4.1.1. Riparian Areas

Riparian ecosystems are generally defined as those areas adjacent to flowing waterways and standing water bodies that have a distinct plant community different than that of nearby uplands. Riparian plant communities provide essential ecological functions, including stabilization of riverbanks, trapping of nutrients and sediments, buffering flood events, and contributing one of the most diverse and productive habitats available (UDWR 1996). Undisturbed riparian zones are home to a wide range of resident and migratory wildlife and provide refuge from predators and extreme summer heat.

Riparian areas throughout Utah have declined or been degraded through stream diversions, groundwater pumping, and extended drought (Hultine *et al.* 2010.) Where alterations in riparian areas have occurred, non-native and invasive plant species have become established. In particular, tamarisk, Russian olive, and purple loosestrife have spread through the Green River's riparian zones, resulting in substantial

changes to the ecosystem (UDWR 1996). Today, cottonwoods, tamarisk, and willows are the predominant members of the riparian plant community throughout the length of the Green River (State of Utah 2013b).

Protection of riparian ecosystems is essential to biological health of the river, but is also highly valued as a natural area for the people of Utah. The Grand County General Plan reports that county residents identified riparian areas as their top priority for the types of open space preferred for recreation (Grand County 2011).

2.4.2. Endangered and Threatened Species and Species of Concern

There are six Federally-listed threatened or endangered plant species known to occur within Emery and Grand counties and no candidate plant species for listing (Table 2-5). The Biological Assessment (Appendix C) provides extensive species analysis and survey data, which serve to verify the “presence” findings in the table. Most of these plants occur southwest of the study area in the San Rafael Swell area and southeast in the Moab area at higher elevations and in other soils derived from other parent material than what is found onsite. Based on these facts, it is unlikely that any of the threatened or endangered listed plant species are present within the study area. The BLM, as a Cooperating Agency on the project, has determined that none of the BLM sensitive plants listed in Emery County are likely to be found within the project area (see attached BLM Plant Survey Memo).

Table 2-5. Federally-Listed Plant Species in Emery and Grand Counties, Utah

Common Name	Scientific Name	Status	County	Presence
Barneby reed-mustard	<i>Schoenocrambe barnebyi</i>	E	Emery	Not in study area
Bolander's camissonia	<i>Camissonia bolanderi</i>	BLM	Emery	Not in study area
Creutzfeldt flower	<i>Crytantha creutzfeldtii</i>	BLM	Emery	Not in study area
Cronquist's buckwheat	<i>Eriogonum corymbosum</i>	BLM	Emery	Not in study area
Dolores rushpink	<i>Lygodesmia grandiflora</i>	BLM	Emery	Not in study area
Green River milk-vetch	<i>Astragalus pubentissimus</i>	BLM	Emery	Not in study area
Horse Canyon stickleaf	<i>Mentzelia multicaulis</i>	BLM	Emery	Not in study area
Jones' Cycladenia (waxy dogbane)	<i>Cycladenia humilis var jonesii</i>	T	Emery, Grand	Not in study area
Last chance Townsendia	<i>Townsendia aprica</i>	T	Emery	Not in study area
Jones indigo bush	<i>Psoralea polydenius</i>	BLM	Emery	Not in study area
Maguire's daisy	<i>Erigeron maguire</i>	Recovery*; BLM	Emery	Not in study area
Mussentuchit gilia	<i>Alicielia tenuis</i>	BLM	Emery	Not in study area
Psoralea globemallow	<i>Sphaeralcea psoraloides</i>	BLM	Emery	Not in study area

Common Name	Scientific Name	Status	County	Presence
San Rafael cactus	<i>Pediocactus despainii</i>	E	Emery	Not in study area
Thompson's talinum	<i>Talinum thompsonii</i>	BLM	Emery	Not in study area
Trotter's alpineparsley	<i>Oreoxis trotteri</i>	BLM	Emery	Not in study area
Utah spurge	<i>Euphorbia nephradenia</i>	BLM	Emery	Not in study area
Winkler pincushion cactus	<i>Pediocactus winkleri</i>	T	Emery	Not likely in area
Wright fishhook cactus	<i>Sclerocactus wrightiae</i>	E	Emery	Not likely in area

*This plant was removed from listing in 2011 and is now on a Recovery list.

2.4.3. Invasive Plant Species and Noxious Weeds

Executive Order 13122 states that “a Federal agency shall not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction and spread of invasive species in the U.S. or elsewhere.”

There are a total of 27 plant species classified as noxious weeds in Utah (UWCA 2013). Noxious weeds are non-native plant species designated by state law or county ordinance because they cause, or have the potential to cause, extraordinary negative economic and ecological impacts. Of these, 19 are reported to occur in Emery County or Grand County (Table 2-6). Noxious weeds are further divided by their level of invasiveness. Class A noxious weeds have low populations with high priority control potential, Class B weeds have moderate populations that are thought to be controllable in most areas, and Class C weeds are categorized as having extensive cover and are beyond control (UCWA 2013). The focus on Class C species is containment of the existing distribution. Each Utah county may also revise the list per local conditions; Emery and Grand counties both include Russian olive on their lists (Emery County Weed and Mosquito Department 2013 and Grand County Weed Department 2012). In addition to the noxious weeds list, UDWR has developed an invasive aquatic species list of plants, which includes common reed (*Phragmites australis*) in both Emery and Grand counties (2009a).

Noxious weed species that have the potential to occur in the study area are shown in Table 2-6. However, no on-site surveys have been conducted to determine presence or extent of invasive plant species and noxious weeds in the study area. Prior to construction, a plant survey will be completed which will indicate which class A and B weed species inhabit the study area. That information will be utilized to develop a Post Construction Site Rehabilitation Plan. The Plan will include mechanisms for addressing weed establishment and treatment.

Table 2-6. Noxious Weeds and Other Invasive Plants Potentially Present in the Study Area

Common Name	Scientific Name	Statewide Class	County Presence
Purple loosestrife	<i>Lythrum salicaria</i>	A	Emery, Grand

Common Name	Scientific Name	Statewide Class	County Presence
Black henbane	<i>Hyoscyamus niger</i>	A	Grand
Diffuse knapweed	<i>Centaurea diffusa</i>	A	Grand
Leafy spurge	<i>Euphorbia esula</i>	A	Emery
Spotted knapweed	<i>Centaurea maculosa</i>	A	Emery, Grand
Yellow toadflax	<i>Linaria vulgaris</i>	A	Emery
Bermudagrass	<i>Cynodon dactylon</i>	B	Emery, Grand
Dalmatian toadflax	<i>Linaria genistifolia</i>	B	Emery
Hoary cress	<i>Cardaria draba</i>	B	Emery, Grand
Musk thistle	<i>Carduus nutans</i>	B	Emery, Grand
Perennial pepperweed	<i>Lepidium latifolium</i>	B	Emery, Grand
Poison hemlock	<i>Conium maculatum</i>	B	Emery
Russian knapweed	<i>Centaurea repens</i>	B	Emery, Grand
Scotch thistle	<i>Onopordum acanthium</i>	B	Emery, Grand
Canada thistle	<i>Cirsium arvense</i>	C	Emery, Grand
Field bindweed	<i>Convolvulus arvensis</i>	C	Emery, Grand
Houndstongue	<i>Cynoglossum officinale</i>	C	Emery, Grand
Quackgrass	<i>Elytrigia repens</i>	C	Emery, Grand
Salt cedar	<i>Tamarisk</i> spp.	C	Emery, Grand
Russian olive	<i>Eleagnus angustifolia</i>	-	Emery, Grand

Data compiled from Belliston et al. 2009. Class A noxious weeds have low populations with high priority control potential, Class B weeds have moderate populations that are thought to be controllable in most areas, and Class C weeds are categorized as having extensive cover and are beyond control (UCWA 2013).

2.5. Animals

2.5.1. Fish and Wildlife Habitat

Fish and wildlife in the study area include a wide range of native and non-native fish, migratory birds, resident birds, mammals, amphibians, and reptiles. Fish populations in the lower Green River are dominated by nonnative channel catfish and common carp as well as native bluehead and flannelmouth suckers.. Habitat for the wildlife species is provided by the cottonwood/willow riparian areas along the river margin, the adjacent greasewood habitat, and nearby cliff faces of the Beckwith Plateau. Wildlife populations that are most well documented and understood include those that are listed for protection under the Endangered Species Act (ESA) or those that are desired hunting targets.

The UDWR manages several large game, mammal, furbearer, and bird game species. Available online mapping shows that the study area provides either year-round, winter, or summer range to three of these species. Pronghorn antelope range includes the study area year-round, Chukar partridge are present in the

study area during winter, and mule deer are year-long residents in the Green River Valley through the study area (UDCD 2013). Other big game species that have been harvested in adjacent management areas include elk, Rocky Mountain bighorn sheep, cougars (UDWR 2011), and black bear (UDWR 2012). Furbearers caught in Emery or Grand County in the 2012–2013 harvest included beaver, bobcat, coyote, grey fox, muskrat, raccoon, red fox, and striped skunk (UDWR 2013a). Other furbearers not included in harvest surveys that are common in the study area include cottontail rabbit and black-tailed and white-tailed jackrabbit (UDWR 2013b). Snakes, lizards, toads, and other reptiles are common near the river. Upland game birds in the study area include Chukar partridge, ring-necked pheasant, and wild turkey (UDWR 2013c). Ducks, shorebirds, herons, and other waterbirds are also common throughout the waterways of Utah. Neotropical migratory and resident birds are also abundant and dependent on the riparian habitat available.

2.5.2. Endangered and Threatened Species and Species of Concern

A Biological Assessment (BA) has been completed for the project (Appendix C) and was submitted to the United States Fish and Wildlife Service (USFWS) in June 2014 to comply with Section 7 of the Endangered Species Act. The results of the BA are summarized below.

The USFWS Environmental Conservation Online System (ECOS) was accessed on March 25, 2014 to obtain a species list for Grand and Emery Counties. The USFWS Information, Planning, and Conservation System (IPaC) was also accessed on March 25, 2014 and a Preliminary Species List was obtained for the project area. California condor (*Gymnogyps californianus*) and Greater sage-grouse (*Centrocercus urophasianus*) were identified on the Grand and Emery County species list, but were not identified as species that should be considered in an effects analysis, according to the USFWS IPaC Preliminary Species List. The proposed project would have **No Effect** to the California condor or the Greater sage-grouse, nor would the project affect their critical habitats. These critical habitats were not included in the USFWS IPaC Preliminary Species List and critical habitat for these species does not exist within the project area. Table 2-7 identifies threatened, endangered or candidate animal species identified in the USFWS IPaC Preliminary Species List or that should be considered in an effects analysis for the proposed project.

The State of Utah sensitive species list includes 34 sensitive animal species within Grand and Emery Counties (UCDC 2011). The Bureau of Land Management (BLM) sensitive species list for Utah includes 42 animal species (USDI-BLM 2012). Information provided by Utah Division of Wildlife Resources (UDWR) identified known occurrences of 2 of the state-listed species (Colorado pikeminnow and razorback sucker) within one mile of the project site. These species are listed in Table 2-7. The remaining BLM/state-listed sensitive species are not anticipated to occur in the project area due to lack of habitat or lack of known occurrence.

Table 2-7. Federally-listed Listed Species in Emery and Grand Counties, Utah

Common Name	Scientific Name	Status	County	Likely to Occur in Study Area
Federally-listed species				
Bonytail*	<i>Gila elegans</i>	E	Emery, Grand	Yes

Common Name	Scientific Name	Status	County	Likely to Occur in Study Area
Colorado pikeminnow*	<i>Ptychocheilus lucius</i>	E	Emery, Grand	Yes
Humpback chub*	<i>Gila cypha</i>	E	Emery, Grand	Yes
Razorback sucker*	<i>Xyrauchen texanus</i>	E	Emery, Grand	Yes
Mexican spotted owl*	<i>Strix occidentalis lucida</i>	T	Emery	Yes
Yellow-billed cuckoo*	<i>Coccyzus americanus</i>	Proposed T	Emery, Grand	Yes
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	E	Emery, Grand	Yes
State-listed species				
Allen's big-eared bat	<i>Idionycteris phyllotis</i>	SPC	Grand	No
American white pelican	<i>Pelecanus erythrorhynchos</i>	SPC	Grand	No
Bald eagle**	<i>Haliaeetus leucocephalus</i>	SPC	Emery, Grand	Yes
Big free-tailed bat	<i>Nyctinomops macrotis</i>	SPC	Grand	Yes
Bluehead sucker	<i>Catostomus discobolus</i>	CS	Emery, Grand	Yes
Burrowing owl	<i>Athene cunicularia</i>	SPC	Emery, Grand	Yes
Colorado River cutthroat trout	<i>Oncorhynchus clarkii pleuriticus</i>	CS	Emery	No
Cornsnake	<i>Elaphe guttata</i>	SPC	Emery, Grand	Yes
Eureka mountainsnail	<i>Oreohelix eurekaensis</i>	SPC	Grand	No
Ferruginous hawk	<i>Buteo regalis</i>	SPC	Emery, Grand	Yes
Flannelmouth sucker	<i>Catostomus latipinnis</i>	CS	Emery, Grand	Yes
Fringed myotis	<i>Myotis thysanodes</i>	SPC	Grand	No
Great plains toad	<i>Bufo cognatus</i>	SPC	Emery, Grand	Yes
Gunnison sage-grouse	<i>Centrocercus minimus</i>	SPC	Grand	No
Gunnison's prairie-dog	<i>Cynomys gunnisoni</i>	SPC	Grand	No
Kit fox	<i>Vulpes macrotis</i>	SPC	Emery, Grand	No
Lewis's woodpecker	<i>Melanerpes lewis</i>	SPC	Grand	No
Mountain plover	<i>Charadrius montanus</i>	SPC	Grand	No
Northern goshawk	<i>Accipiter gentilis</i>	CS	Emery, Grand	No
Roundtail chub	<i>Gila robusta</i>	CS	Emery, Grand	Yes

Common Name	Scientific Name	Status	County	Likely to Occur in Study Area
Smooth greensnake	<i>Opheodrys vernalis</i>	SPC	Grand	No
Spotted bat	<i>Euderma maculatum</i>	SPC	Grand	Yes
Three-toed woodpecker	<i>Picoides tridactylus</i>	SPC	Emery, Grand	No
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	SPC	Emery, Grand	Yes
Western toad	<i>Bufo boreas</i>	SPC	Emery	No
White-tailed prairie-dog	<i>Cynomys leucurus</i>	SPC	Emery, Grand	Yes

* Also identified in the State-Listed Species list, E=Federally Endangered, T=Federally Threatened, C=Federal Candidate for Listing

Based on habitat conditions and species occurrences in the project area, seven Federally-listed species have been identified that are likely to occur or have been documented occur in the project area: Bonytail, Colorado pikeminnow, Humpback chub, Razorback sucker, Mexican spotted owl, Yellow-billed cuckoo and Southwestern willow flycatcher. The project is also considered to be within critical habitat for the Colorado pikeminnow and the Razorback sucker (Figure 2-4). The BA is included in Appendix C and provides further detailed species information, conservation measures, and mitigation commitments.

Based on habitat conditions and species occurrences in the project area, 12 State/BLM-listed species have been identified that are likely to occur in the project area: bald eagle, big free-tailed bat, bluehead sucker, burrowing owl, cornsnake, ferruginous hawk, flannelmouth sucker, Great Plains toad, roundtail chub, spotted bat, Townsend's big-eared bat, and the white-tailed prairie dog. The Species of Concern Memo (Appendix C) provides further detail on the known occurrences of these species, including habitat requirements.

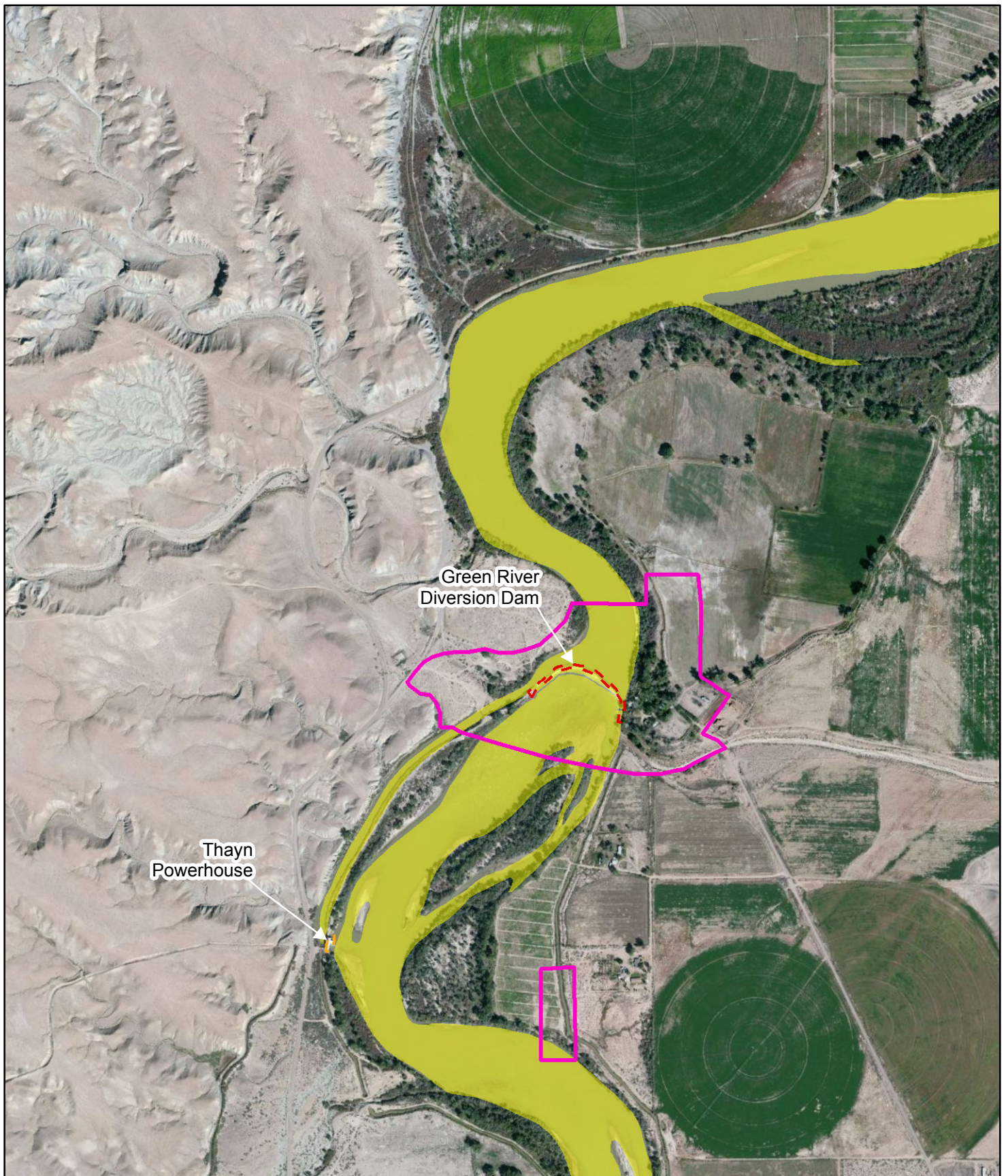


Figure 2-4: Critical Habitat

NRCS Green River Diversion Rehabilitation
Final EIS

0 500 1,000 2,000 Feet

McMILLEN, LLC

DESIGN with Vision. BUILD with Integrity.



Legend

- Thayn Powerhouse
- Green River Diversion Dam
- Project Area
- Colorado Pikeminnow & Razorback Sucker

NOTES:
Aerial photo from Bing imagery service. Capture date September 2010. Points, lines and polygons supplied by various state and federal sources, including BLM, UDOT, and USGS.

2.5.3. Invasive Fish and Wildlife Species

Executive Order 13122 states that “a Federal agency shall not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction and spread of invasive species in the U.S. or elsewhere.”

In response to the 1996 National Invasive Species Act, UDWR prepared an aquatic invasives management plan in coordination with the Utah Aquatic Invasive Species Task Force (UDWR 2009a). Invasive aquatic animals that may occur in the study area include gizzard shad, mosquitofish, and American bullfrog. The UDWR issued a must-kill order effective January 1, 2013 for the entire Green River for the following species: burbot (not found in this reach of the river), channel catfish, northern pike, smallmouth bass, and walleye. Non-native mudsnails and mussels are also a concern in Utah, but are not currently reported to be within the study area. Species accounts provided below are summarized from UDWR (2009a) unless otherwise noted.

2.5.4. Migratory Birds/Bald and Golden Eagles

Under authority of the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712), it is unlawful to take, kill, or possess migratory birds, their parts, nests, or eggs. “Take” is defined as any attempt or success at pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting. Migratory Bird Permits must be obtained through the USFWS Migratory Bird Permit Office for any unavoidable violation of the MBTA.

The USFWS list of birds of conservation concern (USFWS 2008) for the Southern Rockies/Colorado Plateau includes 27 migratory bird species, including the yellow-billed cuckoo, the bald and golden eagle, and the willow flycatcher among others. The Green River corridor and its’ associated floodplains and riparian zones likely provide for habitat to support breeding, nesting, and rearing in certain stretches of the river. The lack of abundant wetlands in the immediate project area, which is generally dominated by cottonwood and Russian olive overstory along with willow and tamarisk woody understory, indicates that the immediate project area provides little in the way of important habitat for the migratory bird populations known in the region.

Wintering, year-round, or breeding populations of bald and golden eagles have the potential to be present in the study area. These birds are afforded particular protection under two separate Acts of Congress. The Eagle Protection Act (16 U.S.C. 668) provides specific protection for bald and golden eagles. The act makes it illegal to take, possess, sell, purchase, barter, or transport any bald or golden eagle, alive or dead, or any part, nest, or egg thereof. “Take” includes pursuing, shooting, shooting at, poisoning, wounding, killing, capturing, trapping, collecting, molesting, or disturbing.

Utah is home to one the largest state populations of wintering bald eagles, with more than 1,200 eagles counted in Utah in recent years (UDWR 2009b). According to UDWR, 25 to 30% of bald eagles wintering in the lower 48 states spend the winter in Utah, indicating the value of habitat in the state (UDWR 2009b). Wintering range includes the study area (UCDC 1999). During winter, bald eagles roost

communally in sheltered stands of trees, typically selecting roosts near an open water body. Prior to 1980 there were no records of nesting bald eagles in Utah (CBD 2007). Since 1983, when the first pair successfully reproduced, Utah's breeding bald eagle population has grown to 11 pairs, recorded in 2007. The Center for Biological Diversity notes that breeding bald eagle pairs were known to be present in Emery and Grand counties. Breeding bald eagles prefer to establish nests in large conifer trees near open water, but will also select cliff faces or ground sites if available (Cornell Lab of Ornithology 2013). Clutches are typically 1 to 3 eggs, incubation lasts 34 to 36 days, and the nesting period can run from 56 to 98 days, typically starting in April. Cottonwood trees along Utah's rivers, lakes, and reservoirs are considered critical for roost and nest sites (UDWR 2009b).

According to UCDC information, high-value habitat for golden eagles is predicted to be present surrounding the study area (UCDC 1997). High-value habitat includes areas that provide for intensive use by a wildlife species. Golden eagles live in Utah year-round and typically forage in open grassland or shrubland habitat, tending to avoid agricultural areas. Prey primarily includes rabbits, hares, ground squirrels, and prairie dogs. During the breeding season, golden eagles occur primarily in areas of mountain cliffs or canyons. In the west, the golden eagle is often associated with rimrock terrain adjacent to open desert or grassland areas. In Utah, golden eagles nest in grasses, shrubs, pinyon-juniper woodland, and aspen-conifer habitats (Peterson 1988, Bates and Moretti 1994). The nesting season is longer than that of typical birds, with more than 6 months between the time eggs are laid until young reach independence. Nesting begins as early as January, but typically occurs in March or later. Golden eagles typically raise an average of only one young per year, though two young are not uncommon when prey is abundant, and may breed for up to 15 years (Kochert et al. 2002).

2.6. Human Environment

This section describes the socioeconomics; cultural resources; potential for hazardous materials in the area; recreation; public health and safety; visual quality, aesthetics, and scenic beauty; land use; infrastructure; and noise within the project vicinity.

2.6.1. Socioeconomics

The socioeconomic area of consideration surrounding the project area can be assessed on a state, regional, and local scale. For the purposes of this study, socioeconomic condition is presented for the state of Utah, Emery and Grand counties, and the city of Green River. The following sections describe current demographic, employment, income, and economic conditions that have the potential to be affected by rehabilitation of the diversion.

2.6.1.1. Lands and Products

Irrigated cropland represents 94.2 and 98.6 percent of the land in farms in the general vicinity of the project. The Green River Diversion provides water supply for the irrigation of over 4000 acres of cropland and for a hydropower plant immediately downstream. Table 2-8 lists 2009 statistics on agricultural lands and products in Emery and Grand counties.

Table 2-8. Land and Products Statistics for Emery and Grand Counties

Statistic (2009)	Emery County	Grand County
Average size of farms	-	561 acres
Average value of agricultural products sold per farm	\$24,950	\$23,145
Average value of crops sold per acre for harvested cropland	\$86.89	\$301.52
The value of livestock, poultry, and their products as a percentage of the total market value of agricultural products sold	86.94%	66.05%
Average total farm production expenses per farm	\$22,086	\$25,191
Harvested cropland as a percentage of land in farms	-	4.65%
Irrigated harvested cropland as a percentage of land in farms	94.20%	98.65%
Average market value of all machinery and equipment per farm	\$45,261	\$35,281
The percentage of farms operated by a family or individual	90.20%	89.36%
Average age of principal farm operators	55 years	54 years
Average number of cattle and calves per 100 acres of all land in farms	-	5.51
Milk cows as a percentage of all cattle and calves	1.96%	-
Vegetables	121 harvested acres	111 harvested acres
Land in orchards	14 acres	80 acres

2.6.1.2. Population

During the 2010 U.S. Census, Utah was home to 2,763,885 people, while Emery and Grand counties had 10,976 and 9,225 people, respectively (Table 2-9; U.S. Census Bureau 2010a). The city of Green River is entirely within Emery County and had a population of 952 people in 2010. Population surrounding the diversion is sparse, with only 114 people in the four nearest census blocks (Census Tract 3 Blocks 2213 and 2172, Census Tract 9765 Blocks 3208 and 3213; U.S. Census Bureau 2010a). Population density in the area of consideration is highest within the boundaries of the city of Green River at 75.5 people per square mile. The state average is 32.5 people per square mile, while Grand and Emery counties have less dense populations at 2.5 people per square mile.

Table 2-9. Population Characteristics by State, County, and City in 2010

Socioeconomic Criteria		U.S.	Utah	Emery County	Grand County	Green River
Total Population		308,745,538	2,763,885	10,976	9,225	952
Gender	Female	156,964,212	1,375,568	5,387	4,579	467
	Male	151,781,326	1,388,317	5,589	4,646	485
Age	Under 18	74,181,467	871,027	3,488	2,118	289
	18 and over	234,564,071	1,892,858	7,488	7,107	663
	20-24	21,585,999	226,519	562	463	60
	25-34	41,063,948	445,687	1,440	1,226	107
	35-49	63,779,197	487,306	1,748	1,848	184

Socioeconomic Criteria		U.S.	Utah	Emery County	Grand County	Green River
	50-64	58,780,854	392,374	2,067	2,127	153
	65+	40,267,984	249,462	1,368	1,251	136

U.S. Census 2010a

While population totals throughout the state and in Emery and Grand counties have grown on average, the population of the city of Green River has declined since the 2000 census (Table 2-10). The 2010 Utah population grew by 23.8% since 2000. In the same period, Grand County grew by 8.7% and Emery County grew by only 1.1%. In contrast, though the city of Green River population has increased since 1990, there has been a 2.1% decline in the past 10 years.

Table 2-10. Past, Current, and Future Population

Population Year	U.S.	Utah	Emery County	Grand County	Green River
Total Population 1990	248,709,873	1,722,850	10,332	6,620	866
Total Population 2000	281,421,906	2,233,169	10,860	8,485	973
Total Population 2010	308,745,538	2,763,885	10,976	9,225	952
Projected 2020 Population	336,031,546	2,990,094	NA	NA	NA
Projected 2050 Population	420,080,587	5,368,567 ¹	NA	NA	NA

U.S. Census 2010. Interactive Population Map. ¹Governor's Office of Planning and Budget, 2005 Baseline Projections.

2.6.1.3. Race and Ethnicity

Race and ethnicity data from the 2010 census are provided in Table 2-11. The area of consideration had a greater percentage of whites and a lower percentage of other races than the State of Utah as a whole in 2010. Conversely, the city of Green River population was 21.4% Hispanic, which was a greater percentage than the entire U.S. population at 16.3%. Emery and Grand counties are predominantly white, with less than 10% Hispanic population. Other races in Emery County account for less than 2% of the population and just over 5% in Grand County. Other races in the city of Green River also comprise less than 2% of the population. No data are readily available for race and ethnicity in local census tract blocks.

Populations that may be disproportionately disadvantaged under environmental justice laws include the Hispanic population of the city of Green River and the American Indian or Alaska Native group in Grand County. Detailed description of environmental justice parameters and those populations that qualify is provided in the Chapter 4, Environmental Consequences.

Table 2-11. Population Composition by Race and Ethnicity in 2010

Race	U.S.	Utah	Emery County	Grand County	Green River
------	------	------	--------------	--------------	-------------

Race	U.S.	Utah	Emery County	Grand County	Green River
White	231,040,398 (74.8%)	237,9560 (86.1%)	10,309 (93.9%)	8,207 (89.0%)	754 (79.2%)
Hispanic	50,477,594 (16.3%)	358,340 (13%)	654 (6.0%)	881 (9.6%)	204 (21.4%)
Two or more races	8,953,620 (2.9%)	75,518 (2.7%)	95 (0.9%)	184 (2.0%)	7 (0.7%)
American Indian or Alaska Native	5,220,579 (1.7%)	32,927 (1.2%)	78 (0.7%)	381 (4.1%)	7 (0.7%)
Asian	17,320,856 (5.6%)	55,285 (2.0%)	38 (0.3%)	77 (0.8%)	5 (0.5%)
Black or African American	42,020,743 (13.6%)	29,287 (1.1%)	26 (0.2%)	29 (0.3%)	3 (0.3%)
Native Hawaiian or Pacific Islander	1,225,195 (0.4%)	24,554 (0.9%)	9 (0.1%)	3 (<.01%)	0 (0%)

U.S. Census Data 2010a, 2010b

2.6.1.4. *Employment and Income*

Overall, the labor market in Utah has slowly recovered from 2008–2009 recession lows, while conditions have remained poor or worsened in some localities (Table 2-12). Utah’s unemployment rate reached a 20-year high of 8.4% in 2009 and had dropped significantly to 4.6% in April of 2013 (U.S. Bureau of Labor Statistics 2013).

Grand County unemployment is seasonally driven, with rates dropping to as low as 2.9% in the summer of 2007 and rising as high as 20.3% in January 2010 (U.S. Bureau of Labor Statistics 2013). This seasonal effect occurs in Emery County as well, but to a lesser degree. Lowest unemployment rates in recent decades occurred in November 2008 when only 2.9% of the labor force was unemployed in Emery County (U.S. Bureau of Labor Statistics 2013). A recent unemployment rate high was reached in January 2011 at 9.7%. The most recent unemployment rate reported for Emery County was 5.8% in April 2013. At the time of this report, the most recently reported unemployment rate for the city of Green River was 4.4% (Find The Data 2013).

Table 2-12. Labor Force Characteristics in 2010

Characteristic	Utah	Emery County	Grand County	Green River
Population 16 years and older	1,948,759	7,843	7257	787
Civilian Labor Force	1,338,755	4,830	4781	464
Employed	1,251,302	4,571	4381	431

Characteristic	Utah	Emery County	Grand County	Green River
Unemployed	87,453	259	400	33
Percent Unemployed	6.5%	5.3%	8.3%	7.1%

U.S. Census Bureau 2010a, 2010b.

The distribution of employment by industry sector is provided in Table 2-13. Annually fluctuating employment rates result from seasonal employment in construction and agriculture, fishing, and hunting in Emery County. In Grand County, seasonal fluctuations are also driven by construction, as well as the seasonal employment for recreational areas. The top employers in Emery County include agriculture, forestry, fishing and hunting, mining, construction, retail trade, educational services, and health care and social assistance. Top employers in Grand County include construction, retail trade, arts, entertainment, recreation, accommodation and food services, educational services, and health care and social assistance. Most residents in the city of Green River are employed in arts, entertainment, recreation, and accommodation and food services.

Table 2-13. Employment by Industry in 2010

Industry Sector	Utah	Emery County	Grand County	Green River
Agriculture, forestry, fishing and hunting, and mining	25,048	785	98	12
Construction	93,672	577	552	38
Manufacturing	134,568	247	101	31
Wholesale trade	35,332	85	155	0
Retail trade	154,277	462	465	72
Transportation and warehousing, and utilities	60,667	397	252	8
Information	28,896	90	124	14
Finance and insurance, and real estate and rental and leasing	84,919	133	201	11
Professional, scientific, management, administrative and waste management services	136,460	161	201	0
Educational services, and health care and social assistance	264,705	929	643	71
Arts, entertainment, and recreation, and accommodation and food services	107,641	261	1,022	131
Other services, except public administration	55,600	181	131	9
Public administration	69,517	263	436	34

U.S. Census Bureau 2010b

Household and per capita income for the area of consideration is provided in Table 2-14. State per capita income has declined from \$30,291 since 2008 (U.S. Census Bureau 2010a). Compared to the state of

Utah, the median and mean household incomes throughout the area of consideration are lower overall. Although per capita income is similar throughout Emery and Grand counties in comparison to the state of Utah, the city of Green River per capita income is 72% of the Utah average.

Table 2-14. Median Income in 2010

Characteristic	Utah	Emery County	Grand County	Green River
Median Household Income	\$57,783	\$50,800	\$42,004	\$38,750
Mean Household Income	\$72,305	\$57,454	\$51,971	\$46,361
Per Capita Income	\$23,650	\$20,257	\$22,135	\$16,978

U.S. Census Bureau 2010b

2.6.1.5. Poverty

Poverty statistics are provided in Table 2-15. Poverty levels in Emery County are lower overall than the state of Utah average. In Grand County, the percent total of all people living in poverty is about 2% higher than throughout the state. However, fewer families are living in poverty in Grand County. The number of the city of Green River's families living below the poverty level comprises 22.2% of the total population, while the number of individuals living below the poverty level is 19.1% (U.S. Census Bureau 2010b). This is substantially higher in comparison to the state averages.

Populations that may be disproportionately disadvantaged under environmental justice laws include the substantial population of the city of Green River living in poverty. Detailed description of environmental justice parameters and those populations that qualify is provided in Chapter 4, Environmental Consequences.

Table 2-15. Poverty Rates in 2010

Characteristic	Utah	Emery County	Grand County	Green River
Percent all people living below poverty level	11.4%	8.6%	13.3%	19.1%
Percent people living below poverty level (18 years and older)	10.7%	8.4%	13.3%	13.3%
Percent families living below poverty level	8.3%	7.5%	5.9%	22.2%

U.S. Census Bureau 2010b.

2.6.2. Cultural Resources/Historic Properties

NRCS conducted a cultural and historic resources study for this project (NRCS 2013c) and this section summarizes that report. The Area of Potential Effect (APE) includes 111 acres, which encompasses the existing diversion, the river within 1,000 feet upstream and downstream of the diversion, and lands on

both the east and west sides of the river that could be used for access or staging associated with the proposed construction.

The study area has been inhabited by humans for at least the past 10,000 to 12,000 years. Archaeological sites are widespread in the region and are relatively common and sites include lithic scatters, low-density ceramic scatters, sporadic wickiups, and projectile points. The Euroamerican artifacts such as tin cans, weaponry, and equestrian tack are common as well, as the Green River valley was used by French-Canadian fur trappers in the early nineteenth century. The Utes were the dominant Native American group present at the time of European exploration.

Agriculture and ranching became the dominant economic activity through the early twentieth century. The development of the interstate highway system further provided access to the city of Green River. Currently, the Green River area is primarily an agricultural community, but outdoor recreation and tourist traffic are also important components of the economy.

NRCS conducted a database search and an intensive cultural resources inventory of the APE in 2013 (NRCS 2013c). A total of eight sites were identified within the project area, including the East Side Canal, the Thayn Canal, the Green River Canal, the Tusher Diversion, the Hastings Ranch, one prehistoric lithic artifact scatter with historic trash scatter, one historic artifact scatter, and two rock panels with historic inscriptions. Table 2-16 below identifies the key elements of each of the eight sites and a preliminary determination of eligibility made by NRCS.

Table 2-16. Cultural and Historic Sites in the Study Area

Site Name/ Description	Key Elements	Preliminary Determination of Eligibility
East Side Canal	Headgate and siphon, historic sluice gate	Eligible
Prehistoric lithic scatter/ Historic trash scatter	Chert and chalcedony flakes, fire-cracked rock; historic can and glass debris	Pre-historic artifacts eligible; historic artifacts not eligible
Historic artifact scatter	Historic cans and glass debris, shallow pits, historic road segment	Not eligible
Two rock panels	Rock art panels with historic inscriptions	Not eligible
Thayn Canal	Canal, pumps, pipes	Eligible
Green River Canal	Headgate, earthen canal	Eligible
Tusher Diversion	Broad crest weir structure, west-side raceway, east-side raceway	Eligible
Hastings Ranch	Waterwheels, farmhouse, outbuildings	Eligible

The APE for the proposed action encompasses approximately 111 acres. This includes the main channel of the Green River where rehabilitation work on the existing diversion would be completed, and adjacent land along the eastern and western banks of the river where the staging of equipment and materials would take place. The APE encompasses a larger area than what would be directly affected by the proposed

undertaking. The APE was expanded in order to take into account secondary effects from material staging, heavy equipment operation, construction access, and potential variation in water levels in the Green River resulting from changes in the elevation of the proposed diversion.

2.6.3. Hazardous, Toxic, and Radioactive Waste (HTRW)

Hazardous, toxic, and radioactive waste (HTRW) includes any liquid, solid, gas, or sludge that poses a hazard to human health or the environment because of its quantity, concentration, or physical or chemical characteristics. To determine whether HTRW sites occur within the study area, an online review of hazardous sites was requested from Environmental Data Resources, Inc. (EDR) (EDR 2013). The EDR field check results show that there are no known HTRW sites within the ASTM International established search radius of a quarter-mile from the diversion. Two orphan sites (those sites missing an exact address) are reported as occurring within or near the city of Green River including the Green River Material Site 2 miles south of Hastings Avenue and Book Cliffs Energy Corporation east of the city of Green River. Both of these orphan sites are at distances that are unlikely to affect the study area. EDR data are compiled from Federal, state, and tribal lists of known hazardous sites, as well as additional environmental records websites (EDR 2013). This comprehensive online survey of potential HTRW sites does not certify the current condition or location of named sites and does not verify that potentially hazardous sites are absent from the study area. On-site surveys would be necessary to ensure the lack of potential HTRW sites prior to construction.

2.6.4. Recreation

2.6.4.1. *Wild and Scenic River Suitability*

Congress created the National Wild and Scenic River System in 1968 to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The BLM manages and evaluates rivers on BLM lands through the resource management planning process. In accordance with the provisions of the Wild and Scenic Rivers Act, the evaluation is a sequential process: eligibility (inventory); tentative classification; and suitability for inclusion in the National Wild and Scenic Rivers System. The Green River in Utah is considered to be suitable for designation as a Wild and Scenic River in 4 segments upstream and 1 segment downstream of (and not including) the project area:

- Nine Mile Canyon to Chandler Canyon - a 44.5-mile stretch considered “Wild”
- Chandler Canyon to Florence Creek - an 8-mile stretch considered “Scenic”
- Florence Creek to Nefertiti Boat Ramp - a 19-mile stretch considered “Wild”
- Nefertiti Boat Ramp to Swaseys Boat Ramp - an 8-mile stretch considered “Recreational”; 3.4 miles upstream of the diversion, and
- Downstream of the project area: The confluence of the San Rafael River (30 miles downstream of the diversion) to Canyonlands National Park - a 50-mile stretch considered “Scenic”.

2.6.4.2. Parks

The state of Utah is home to five national parks, seven national monuments, and numerous other national recreation and historic sites. Each of the recreation areas is operated and maintained by one of the following entities: the National Park Service (NPS), BLM, or the Utah State Parks and Recreation Department of the Utah Department of Natural Resources (UDNR). The city of Green River is located amidst the magnificent recreational opportunities that occur in the local area and in the southern portion of the state. Located between Highway 191 South and Highway 24 South, the city of Green River is the jumping off point to Arches National Park, Canyonlands National Park, the north side of Glen Canyon National Recreation Area, Goblin Valley State Park, Natural Bridges National Monument, and numerous other recreation areas. Locally, Emery and Grand counties are home to a total of five state parks, including Green River State Park within the city of Green River.

Outdoor recreation is the primary component of Utah's tourism industry. In 2011, tourists spent \$6.87 billion in tourism-related activities and the tourism industry employed over 124,000 people (Governor's Council on Balanced Resources 2013). There were 4.8 million visits reported to Utah's state parks in 2011, raising revenue from day-use, camping, golf, and other fees. Skiing provides the greatest boon to Utah's tourism economy, generating over a billion dollars in 2011. The number one employer by percent in Utah is the outdoor/sporting goods industry.

Two BLM-managed sites provide services for recreationists in the vicinity of the project. Swasey's Beach/Boat Ramp includes a launch and take-out, parking, trash collection and restrooms, while The Beach (located just upstream of Swasey's) provides campsites, parking and restrooms as well. Green River State Park is the closest state facility providing public recreation access. Park amenities include boat launches, lodging, tent and recreational vehicle (RV) camping, restrooms with showers, picnic tables and fire pits, group sites, and a golf course. Features and details for these amenities are described in Table 2-17. Other recreational areas within the city of Green River include local parks and sporting fields. A community center and visitor center are also present and provide additional recreational information for the area.

Table 2-17. Green River State Park Facilities and Services

Facility/Service	Features	Season	ADA	Pets	Permit
Boat launch area	Day-use Cabanas	Spring, Summer, Fall, Winter	Yes	Yes	No
Cabins	Cabins	Fall, Spring, Summer, Winter	Yes	No	No
Docks	Docks				
Drinking Water	Drinking Water	Spring, Summer, Fall, Winter			
Fire pits	Fire pits	Spring, Summer, Fall, Winter			
Golf Course	Golf Course	Spring, Summer, Fall, Winter	Yes	No	Yes
Group	Barbecue Grills	Spring, Summer, Fall, Winter	Yes	Yes	
Group	Campsites - RV	Spring, Summer, Fall, Winter	Yes	Yes	Yes

Facility/Service	Features	Season	ADA	Pets	Permit
Group	Campsites - Tent	Spring, Summer, Fall, Winter	No	Yes	Yes
Group	RV- Electric Hookups	Spring, Summer, Fall, Winter	Yes	Yes	Yes
Group Camping	Group Camping	Spring, Summer, Fall, Winter	Yes	Yes	Yes
Group Day-Use	Group Day-Use	Spring, Summer, Fall, Winter	Yes	Yes	Yes
Group Pavilion	Group Pavilion	Spring, Summer, Fall, Winter	Yes	Yes	Yes
Launch Ramp	Launch Ramp	Spring, Summer, Fall	Yes		
Main	RV - Electric Hookups	Spring, Summer, Fall, Winter	Yes	Yes	Yes
Main	Barbecue Grills	Spring, Summer, Fall, Winter			
Main	Campsites - RV	Spring, Summer, Fall, Winter	No	Yes	Yes
Main	Campsites - Tent	Spring, Summer, Fall, Winter	No	Yes	Yes
Modern Restrooms	Modern Restrooms	Spring, Summer, Fall, Winter	Yes		
Picnic Tables	Picnic Tables	Spring, Summer, Fall, Winter	Yes		
Sewage Disposal Station	Sewage Disposal Station	Spring, Summer, Fall, Winter			
Showers	Showers	Spring, Summer, Fall, Winter	Yes		
Wedding Venue	Wedding Venue	Spring, Summer, Fall, Winter	Yes	No	Yes

Source: Utah State Parks 2013

2.6.4.3. Boating

The Green River was part of the historic John Wesley Powell expedition from the city of Green River, Wyoming to the confluence with the Colorado River near present-day Moab in 1869. The John Wesley Powell River History Museum is located on the east bank of the Green River at 1765 East Main Street and provides exhibits including artwork, a boat room, dinosaurs, a pavilion, a theater with a documentary about the Powell expedition, and a river runner's hall of fame.

Boating on the Green River remains an extremely popular sport. There are no developed recreational facilities within the study area. Paddling the river requires a permit issued by the BLM (portions also require a permit from the Ute Tribe Fish and Wildlife Department) to pass through reaches above the study area in Desolation Canyon. Once boaters leave Desolation Canyon and enter the Green River valley, most pull their boats out of the river on the east side at Swaseys Beach/Boat Ramp (Figure 2-5) and do not float down to the diversion because it is often not navigable. Although, some boaters do float over the diversion and pull out of the river at Green River State Park or keep on floating further downstream. The diversion structure creates a strong current in the river through a gradient glide, instead of a typical diversion drop off, and in most flow levels it is preferable to wet portage over the diversion. During low flows in the river, portions of the diversion become exposed and flows are not desirable for wet portage.

Most rapids from Sand Wash at River Mile (RM) 32 to the diversion at RM 119.7 are Class I or II, with six rapids classified as Class III. Higher classifications could occur during extreme high flows. Optimum paddling occurs from mid-spring through late fall, but may be shorter or longer depending on snowmelt conditions in the spring and ice formation in the fall. Green River State Park is a popular place to pull out of the river after paddling from points upstream.

2.6.4.4. General Recreation

Land around the site is federally managed on the west and privately owned on the east with no developed amenities. However, it is possible that recreationists may approach the site from the public land managed by the BLM on the west bank to hunt, fish, or appreciate nature (see land ownership, Figure 1-3). Recreational fishing is regulated on the Green River by the Utah Division of Wildlife Resources (UDWR). Nonnative channel catfish and common carp as well as native bluehead and flannelmouth suckers are known to populate the project area. Within recent years, big game and other mammals hunted and/or harvested in the management units that include the study area included mule deer, elk, pronghorn, Rocky Mountain bighorn sheep, cougar, black bear, beaver, bobcat, coyote, gray fox, muskrat, raccoon, red fox, and spotted skunk (UDWR 2013). Upland game birds, turkeys, and waterfowl are also popular hunting targets in the area.

In 2009, Utah Governor Jon Huntsman Jr. certified the Statewide Comprehensive Outdoor Recreation Plan (SCORP), which represented a team effort among state entities to compile recreation data and public opinion about recreation in Utah. This report is intended to provide a review of the recreation available to the people of the state, as well as their perceptions of its quality and availability. The diversion rehabilitation study area is within the portion of the state grouped together as the Southeastern planning district.

According to the SCORP, citizens in the Southeastern planning district reported the highest participation in recreation activities such as walking for pleasure or exercise, picnicking, camping, wildlife or bird watching, and running. Other popular activities included fishing, playground activities, and off-highway vehicle (OHV) riding. Recreation facilities that were considered of high importance in this district included camping areas, natural areas, city parks, OHV riding areas, and playgrounds. Overall, residents within the Southeastern planning district were highly satisfied with the availability of city parks, natural areas, ball fields, camping areas, playgrounds, and OHV riding areas.



Figure 2-5: Recreation
 NRCS Green River Diversion Rehabilitation
 Final EIS

McMILLEN, LLC
 DESIGN with Vision. BUILD with Integrity.



Legend



Boat Ramps



Green River

0 3,000 6,000 12,000 Feet

NOTES:
 Aerial photo from Bing web
 service. Capture date
 September 2010.

2.6.5. Public Health and Safety

Personal safety at the Green River Diversion has been managed through aggressive permitting regulations by the BLM (Price, Utah; Desolation Canyon River requirements; BLM 2014). Generally speaking, a low head dam such as the Green River Diversion may create dangerous downstream turbulence capable of entrapping small crafts such as canoes or kayaks. There is a reasonable likelihood that recreational (and unpermitted) users of this stretch of the Green River will be exposed to this hazard along with the hazards associated with structural damage that has occurred (and the possibility of in-stream obstructions such as exposed rebar and broken concrete). The lack of a nearby beach on the west side (BLM-managed property) poses another possible threat, as there is no designated exit point on the river when a user identifies the diversion as a hazard and a barrier.

The diversion itself is located in both Emery and Grand counties. Public health and safety services, including law enforcement, fire protection, health care, and emergency services, are provided to the project area by facilities in the nearby city of Green River, which is located in Emery County. This section provides an overview of the organizations and facilities that service the project area, as well as the current public health and safety conditions. A summary is provided in Table 2-18.

Law enforcement services for incidents that occur on the west side of the Green River and within the city of Green River, are provided by the Emery County Sheriff's office, while those that occur on the east side are under the jurisdiction of the Grand County Sheriff's office. However, the nearest law enforcement offices are located in the city of Green River and are operated by the Emery County Sheriff. In addition, the Utah Department of Safety Highway Patrol maintains an office in town; this facility provides law enforcement response to incidents occurring on the interstate highway system. Incidents occurring in Grand County are serviced by law enforcement located in Moab, Utah, approximately 60 miles and over 1 hour away.

In the event of a medical emergency call to 911, the Emery County Ambulance Medical Control Doctor would determine the nearest facility appropriate for emergency treatment services. The nearest emergency treatment facilities to the project area are present in town, which would be reached via ambulance. If local emergency facilities cannot provide adequate treatment, the medical control service may direct an ambulance or life flight to a more distant facility in the city of Price. Grand County Emergency Medical Services would provide emergency response ambulances or life flight to incidents occurring on the east side of the Green River. The nearest fire station is in town, and wildfire response is dispatched by the Moab Interagency Fire Center.

Table 2-18. Public Health and Safety Services and Facilities in the Project Area

Service	Office	Address	Phone Number
Law Enforcement	County Seat Emery County Sheriff	P.O. Box 817 Castle Dale, UT 84513	(435) 381-2404

Service	Office	Address	Phone Number
	Local Office Emery County Sheriff	80 Farrer Street Green River, UT 84525	(435) 564-3431
	Grand County Sheriff	25 South 100 East Moab, UT 84532	(435) 259-8115
	Utah Department of Public Safety Highway Patrol	420 East Main Street Green River, UT 84525	(435) 564-3474
Fire Protection	Green River City Fire Department	P.O. Box 66 Between Cherry Street, Green River Avenue and W 200 S Street. Green River UT 84525	(435) 564-3229
	Moab Interagency Fire Center	70 E Fire Center Dr. Moab, UT 84532	(435) 259-1850
Health Care	Green River Medical Center	585 W. Main Street Green River, UT 84525	(435) 564-3434
	Castleview Hospital	300 Hospital Drive Price, UT 84501	(435) 637-4800
Emergency Services	Emery County Ambulance	PO Box 907 75 East Main Street Castle Dale, UT 84513	(435) 381-3577
	Grand County Utah Emergency Medical Services	125 East Center Street Moab, UT 84532	(435) 259-1301

2.6.6. Visual/Aesthetics and Scenic Beauty

Aesthetic conditions of the project area can be assessed both spatially and temporally, as visual quality changes over landscape scale and with the seasons. Visitors to the area include adjacent homeowners, local Green River area residents, and recreationists passing through the study area via land or water.

As part of the Colorado Plateau in the desert southwest, the study area is rich in stark contrasts. Gently undulating lowlands through the Green River Valley give way to the abrupt rise of table mesas and rocky buttes that characterize the Beckwith Plateau to the west, north, and east of the study area (Picture 2-1). Dominating the horizon to the west of the project area are Blue Castle and Battleship Buttes, while Gunnison Butte rises to the north. Tusher Wash comprises the lowland elevations to the east.

During summer, grasses, shrubs, and trees create a green ribbon along the river margin, separating the blue of the river from the tan of the rising plateau (Picture 2-2). Riparian vegetation is most abundant and provides the visual softening of the river valley during summer with native species of cottonwood and willow. Tamarisk and Russian olive are also present in the study area. These non-native species have the potential to substantially compromise the visual quality of the vegetation with dense monocultures. During winter, the primarily deciduous trees of the riparian zone lose their leaves and the green margin of

the river disappears (Picture 2-1). Snow may cover the landscape and ice forms on slower-moving portions of the river.

The river is wide and sinuous upstream and downstream of the diversion. At lower flows (less than 2,000 cfs, for example), cobble bars and debris are exposed in the middle of the river, along with the diversion and appurtenant structures. The diversion is a concrete structure extending in an arc across the river in an east to west alignment. Diversion structures, canals, and a waterwheel are all part of the visual character of the site (Pictures 2-1, 2-2, and 2-3). Recent flood events caused substantial damage to the diversion and cracks in the structure are now visible (Picture 2-4).



Picture 2-1. Looking Northwest Toward Beckwith Butte

Diversion structure in foreground during winter season



Picture 2-2. Looking North Northwest across Diversion Structure

Summer season (flow at this time of the year would be approximately 4,000 – 5,000 cfs over the diversion).



Picture 2-3. New and Old Water Wheel at the Hastings Ranch, East Side



Picture 2-4. Damaged Diversion Structures, East Side

2.6.7. Land Use

The Green River is located in Emery and Grand counties and provides most of the irrigation water used in the area. The study area is comprised of several different land covers. On the west bank of the Green River in Emery County, land immediately adjacent to the diversion is primarily categorized as salt desert shrubland (UACD 2012) managed by the BLM. Within this category is a small area that has been highlighted as being dominated by invasive plants. To the north and south of the diversion, remaining land in the study area is categorized as agricultural. All agricultural land in the study area is in cropland.

Land ownership (Figure 1-3) through the study area is divided among private land holders, public lands (BLM), and Utah School and Institutional Trust Land (UACD 2011, 2012). On the west bank, BLM manages the land immediately adjacent to the diversion. Institutional Trust Land is present south of the BLM land near the control gate, and private land is south of that. Private land is also present on the west bank to the north of the BLM land. On the east bank, land is almost entirely in private ownership. A small pocket of Institutional Trust Land is present, but does not border the river. The State of Utah, Division of Forestry, Fire, and State Lands, by virtue of its sovereignty, owned the bed of the Green River below the ordinary high water mark at statehood in the project area. A Special Use Lease would be required for construction activities and structures located in on the bed of the river.

2.6.8. Infrastructure

The diversion and appurtenant structures include the concrete sloped crest weir diversion, control gate on the west side of the diversion, concrete diversion structure, and East Side Canal that diverts flows to the water wheel, Thayn Canal on the west with a control gate that leads water to the hydropower plant, and the Green River Canal that branches from the hydropower plant via a control gate (Alpha Engineering Company 2010). Prior to damage caused in the 2011 flood event, the stakeholders had identified a number of deficiencies with the diversion including deterioration, sediment loading, inability to meet water right diversions, flooding, loss of habitat, and limitations to recreation.

Transportation to the study area is provided via Interstate 70, whether approaching from the east or west by vehicle, and is the primary arterial conveying traffic. From the east, vehicular traffic exiting off I-70 at Exit 164 takes an 8-mile trip to arrive at the study area. Traffic turns onto State Highway 19 (UT-19) or East Main Street and then turns north onto Hastings Road, which provides access to the land held in private or federal ownership to the east of the Green River. From the west, traffic takes Exit 160 from I-70 to reach UT-19 going east. Traffic then takes a turn north on North Long Street. After approximately 5 miles, the paved road gives way to loose gravel for the final mile. Unpaved roads on BLM-owned land provide access to the west side of the Green River.

Railroad passenger travel is provided by Amtrak along the Union Pacific-owned tracks (Amtrak 2012). The California Zephyr is the only national passenger train moving through Utah and provides twice daily service between Chicago, IL and the San Francisco Bay area. The Green River station is at 250 South Broadway. In the 2012 fiscal year, this train recorded 2,478 boardings at the Green River Station (Amtrak 2012). Also in 2012, a new shelter was built with benches and lighting.

Green River Municipal Airport (Airport U34) is a general aviation facility located 4 miles southwest of the city of Green River and is the nearest airport serving the study area. It is owned by Green River City Corp (FAA 2013). Salt Lake City International Airport is 182 miles away and provides the nearest commercial and international air service.

Utilities providers in the project area include Amerigas and BlueBoX Phone Labs (Google Maps 2013). Aerial photography shows that a utility line passes over the Green River directly above the diversion.

2.6.9. Noise

Applicable noise laws for the project area are provided in the Noise Control Act of 1972 (42 U.S.C. 4901 et seq.), amended by the Quiet Communities Act of 1978 (42 U.S.C. 4913), which promotes the development of state and local noise control programs. The State of Utah has not developed a statewide noise law and Emery County has not developed a countywide noise ordinance. Grand County Land Use Code (LUC) noise laws restrict noise from specific activities, such as mining, but does not set noise level limits (Grand County 2008). The Zoning Ordinance of the City of Green River states generally that it has been designed to protect residents from noise and other objectionable conditions (City of Green River 2012). However, no noise level limitations are defined in the ordinance. Ambient noise in the project area has not been measured, and therefore no baseline is available, although the only noise sources in the study area would be naturally-derived sounds such as the river, birds, insects, and animals; agricultural equipment and pumps for irrigation; occasional vehicle traffic; and recreational users.

Noise-sensitive receptors are those facilities, land areas, or wildlife populations that require lower noise levels for health and function. Examples include residential neighborhoods, medical facilities, schools, churches, research facilities, parks, and open space.

Noise-sensitive receptors within the immediate project area include residential homes. However, the only home within the immediate area is not currently occupied. The nearest noise-sensitive receptors are residential structures located south of the diversion and along the East Side Canal more than 0.5 miles away.

CHAPTER 3. ALTERNATIVES

3.1. Formulation Process

The process of formulating alternatives for rehabilitation of the diversion followed procedures outlined in the NRCS National Environmental Compliance Handbook (USDA NRCS 2011). Numerous alternatives were developed by the project team based on the ability to address the purpose and need of the project. Some of the initial alternatives were eliminated from further analysis due to high cost or other critical factors. The project team developed a series of questions and filters to help formulate alternatives:

➤ *Initial Screening Questions:*

- Does the concept/alternative meet purpose and need?

Several alternatives were eliminated from further study upon the application of the initial screening question. A baseline alternative was developed at this stage of the process to demonstrate rehabilitation of the diversion.

➤ *Secondary Post-Scoping Screening Filters:*

- Is it consistent with established design criteria, engineering practices, etc.?
- Is it reasonable and feasible, and within the established NRCS EWP scope of work and funding allocation?

3.2. Alternative Concepts and Options Considered but Eliminated from Detailed Study

A range of alternatives and options was considered for study early in the project scoping phases. As listed in Section 1.4.2 of this document, project components were identified through agency and public scoping efforts. Initial analysis included the following general types of diversion alternatives, but most were eliminated from detailed study because they did not meet the purpose and need, were considered infeasible, would not be consistent with established engineering practices or NRCS design criteria, or were deemed too costly for the project. The range of eliminated alternatives are listed below; further description and detail for each can be found in Table 1-2 of the Concept Design Report (Appendix B):

- Stoplog Dam
- Dam at Canyon Outlet
- Bladder Weir
- Straight Concrete Diversion
- Downstream Arcing Diversion
- Riprap Ramp
- Rock Weir Series
- Riprap Ramp Series
- Far Upstream Diversion
- Decommissioning, Pumping, and Buyout
- Low Diversion and Buyout
- Water Park Style Diversion
- Replace Alternatives with Hastings Berm Improvement
- Replace Alternatives with Hastings Field Drain Outlet
- Replace/Rehabilitate Diversion
- Repair Diversion In Place
- Replace Diversion Upstream or Downstream

3.2.1. Conceptual Alternatives

The questions of how to rehabilitate the existing structure and also meet the project purpose and need were the initial factors in conceptual alternative development. The following general alternative concept types were the baseline for all others that have been analyzed as part of the process.

3.2.1.1. *Dam Decommissioning*

Complete removal of the diversion (dam) would entail the excavation and disposal of the entire concrete diversion and reclamation of the river channel and banks to match existing contours. A new stable channel would allow unobstructed flow through the upstream and downstream reaches of the Green River. Complete removal of the diversion would not allow any water to be diverted for irrigation purposes, and would also involve the buyout of the Thayn Hydropower plant. The elimination of water diversion altogether does not meet the purpose and need for this federally funded project and supplemental methods would be required to acquire the same water volume as allotted by water right. The cost estimate for acquiring new water sources (new wells, water purchase, new dam, etc.) and the buyout would cost between \$10,000,000 and \$15,000,000. Therefore, the dam decommissioning concept was eliminated from detailed study.

3.2.1.2. *Replace Diversion Far Upstream or Downstream*

Complete diversion removal and replacement far upstream or downstream in a different location would entail the excavation and disposal of the entire concrete diversion and reclamation of the river channel and banks to match existing contours. A new stable channel would allow unobstructed flow through the upstream and downstream reaches of the Green River. The project would also involve the construction of new canals and laterals to provide water to the East Side and Green River canals, as well as the buyout of the Thayn Hydropower plant. Complete removal of the diversion would lower the water surface at the existing location, rendering the Hastings Water Wheel unusable. Connecting the diversion to the existing canals would require canal connections which, depending on the structure's distance upstream, could be prohibitively expensive. The project footprint would be substantially larger, potentially impacting environmental resources. Supplemental methods would be required to acquire the same water volume as allotted by water right. The cost estimate for constructing connections to water conveyances would be prohibitively expensive. Therefore, the replace far upstream or downstream concepts were eliminated from detailed study.

3.2.1.3. *Replace Diversion with a Different Structural Type or Shape*

Replacement diversion types assessed were of a stop-log type, bladder weir, riprap stepped channel, or a different shape such as straight or downstream arc. While some of these types would provide irrigation to water users and could provide adequate fish passage, disadvantages such as higher operation and maintenance demands; increased bank instability and scouring; vegetation losses; and a high risk of vandalism rendered these eliminated from further study.

3.2.1.4. *Rehabilitate or Replace Diversion*

The existing diversion structure has been operated and maintained in its existing form and location for over 80 years. This design would divert water to the canals and include components for fish and boat passage. Operation and maintenance could be similar to what is currently done and would allow for improvement in terms of efficiency. Therefore, the rehabilitate or replace diversion (in the same location) concept was carried forward to be analyzed. This concept was expanded into the alternatives evaluated as part of this process.

3.3. Proposed Action

Based on the screening of the range of alternatives that accounted for water right delivery, engineering practicability, environmental impacts, and public and participating agency input, the Proposed Action is recommended (the “preferred alternative” is a combination of the components, and is presented in Section 3.6).

The Proposed Action would rehabilitate the Green River Diversion, which is necessary due to damage caused by past flood events; upgrade the diversion infrastructure to current design standards; maintain the level of water delivery to the existing water rights holders; and, comply with applicable Federal rules and regulations. The Proposed Action would maintain existing functions of the diversion for water delivery to water rights holders, thereby meeting the Project Purpose and Need.

The Proposed Action is a list of alternative components that were favored by the public, cooperating and participating agencies (see Figures 3-1 through 3-3):

- Replace existing diversion structure.
- Level structure crest to elevation 4086.7' to ensure water delivery to irrigation systems and provide sufficient water for bypass flows at fish protection systems
- Move sediment through the system and maintain floodwater conveyance.
- Replace existing gate and bridge at west raceway and provide sufficient water for bypass flows at fish protection systems.
- Improve east side raceway to water wheel.
- Reinforce the diversion structure with riprap.
- Dredge the large deposition area at the mouth of Tusher Wash for a source of cobble and gravel during construction.
- Construct a new siphon intake at the east side canal.
- Install deflection log booms at the east and west ends for public safety and structure protection.
- Provide upstream fish passage past diversion structure.
- Provide downstream fish passage via notches in the diversion structure.
- Provide passive integrated transponder (PIT) tag detectors to sense and record fish movement over and around the diversion.

- Install fish screen and bypass at the east side canal.
- Provide both dry and wet downstream boat passage past the diversion structure.
- Install boater warning signs upstream of the diversion for public safety.

Emergency watershed protection measures must adhere to all applicable Federal, State, Tribal, and local laws and regulations. The fish passage components are required by the Endangered Species Act. The boat passage components are a navigation requirement of the state.

The following lists the water rights and flow allocations associated with the Proposed Action list above:

Hydropower – 600 cfs	Downstream Fish Passage – 40 cfs
Irrigation – 219 cfs	Upstream Fish Passage – 30 cfs
Downstream Boat Passage – 147 cfs	Fish Screen Return Flow – 20 cfs
Fish Barrier Return Flow – 50 cfs	

3.4. Alternatives Analyzed

Two Action Alternatives were carried forward by NRCS and the project team and were analyzed in detailed study in the DEIS. In accordance with NEPA, the No Action Alternative was also analyzed. The NRCS NEPA manual states that the EIS should identify the agency's preferred alternative. The preferred alternative is the alternative that the lead agency (NRCS) believes would fulfill its statutory mission and responsibilities considering economic, environmental, technical, and other factors (46 Federal Register [FR] 18026). The preferred alternative has been chosen and is presented in Section 3.6.

3.4.1. No Action Alternative

The No Action Alternative would consist of using no Federal money to rehabilitate the Green River Diversion. Due to the cost associated with the rehabilitation of the diversion, it is likely that no repairs would be made by the stakeholders to the severely damaged structure; it would not be upgraded to current engineering standards and technology, and would provide very limited fish passage and no boat passage. The sediment control/slucice gates would also remain in their current condition. This alternative, therefore, represents the scenario in which the diversion may likely fail during an extreme flood event in the future.

3.4.2. Replace In Place Alternative

This baseline alternative (Figure 3-1) would replace the diversion structure at the same historic location as the existing diversion. The diversion structure or "weir" length would remain the same as the existing. The rehabilitate alternative would maintain the existing east side and west side tie-in locations to the bank, where feasible. The alternative would upgrade the structure to current engineering standards and technology. The 750-foot, arc-shaped crest of the weir would be leveled at 4086.7' to ensure delivery to water users (Figure 3-2). This alternative would include one new gate for water control and sluicing; and a new bulkhead gate structure and 80-foot raceway to the water wheel on the east side at the Hastings Ranch to maintain existing water rights. As part of the diversion rehabilitation, all existing water rights would be maintained.

On the west side of the diversion, the Green River Canal and powerhouse raceway would be controlled by the existing gate bridge/structure. To reduce debris collection and as a safety measure, two deflection log booms would be positioned across the raceway entrance. The 100-foot long west side and 170-foot long east side log booms would tie into a sluice gate in order to pass the debris past the weir and avoid blockages. At the east side, a new siphon intake for the East Side Canal would be constructed.

Downstream fish passage across the diversion would not be provided by this alternative. Upstream fish passage would be restored to pre-2011 flood conditions on the east side of the structure.

The diversion structure itself would be designed for safe passage over the diversion by boats during passable flows by creating a gradual slope that does not form an eddy that could trap boaters underwater. Boater warning signs would be placed at locations above the diversion on both banks.

This alternative would also require the temporary use of approximately 5.5 acres of BLM-managed public lands, 15.9 acres of state sovereign lands (Green River itself), and 2.3 acres of private lands for staging and access during construction (Figure 3-5).

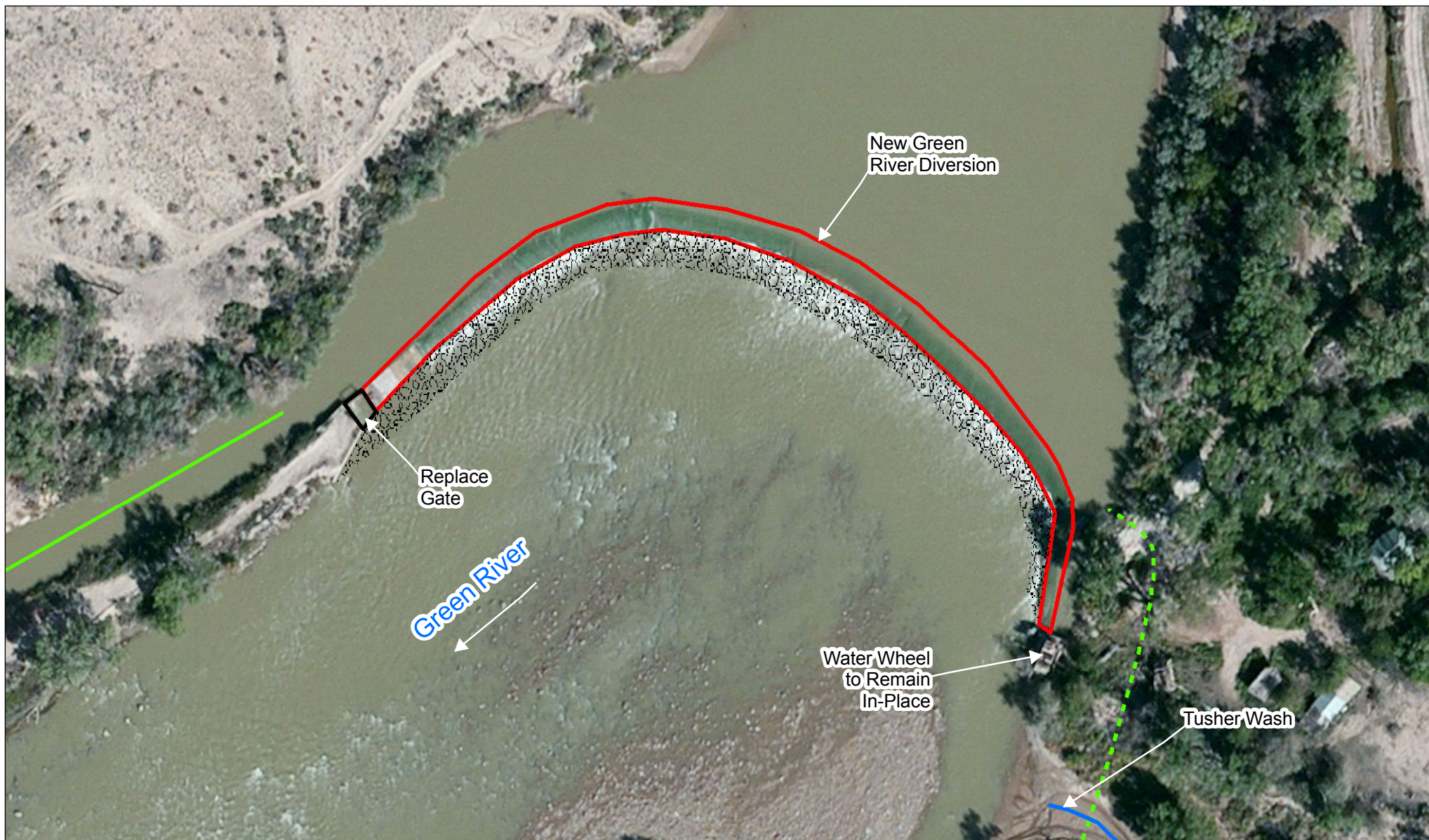


Figure 3-1: Replace In-Place

NRCS Green River Diversion Rehabilitation
Final EIS

0 50 100 200 Feet



McMILLEN, LLC
DESIGN with Vision. BUILD with Integrity



Legend

— Canal

— Stream

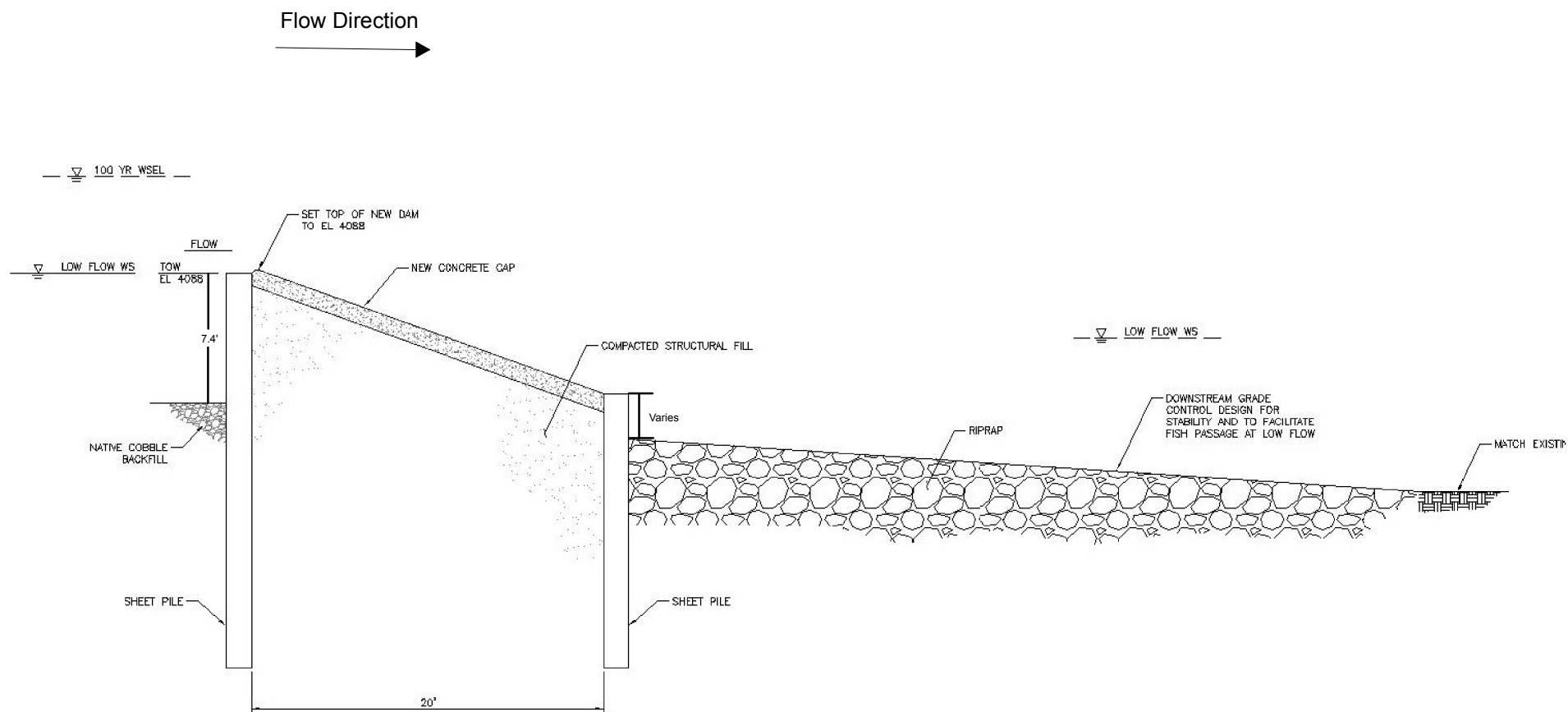
- - - Subsurface Canal

▭ Green River Diversion

▨ Riprap

NOTES:

Aerial photo from Bing imagery service. Capture date September 2010. Plan features are approximated and not to scale or defined as final plan.



Not to Scale

Figure 3-2: Replace In-Place Diversion Cross-Section

NRCS Green River Diversion Rehabilitation
Final EIS



McMILLEN, LLC
DESIGN with Vision. BUILD with Integrity

NOTES:

Cross-Section from McMillen, LLC
Concept Design dated March 7, 2014.
Plan features are approximated and not
to scale or defined as final plan.

3.4.3. Replace In Place With Passages Alternative

This alternative (Figure 3-3) would demolish the existing diversion and install a new diversion in the same historic location. This alternative would replace the existing diversion along the current alignment and upgrade the structure to current engineering standards and technology. The 750-foot, arc-shaped crest of the weir would be leveled to 4086.7' to ensure delivery to water users (Figure 3-2). This alternative would include two new gates for water control and sluicing; and a new bulkhead gate structure and 80-foot raceway to the water wheel on the east side at the Hastings Ranch to maintain existing water rights.

On the west side of the diversion, the existing gate structure would be replaced to provide more efficient water control and sluicing capabilities for the Green River Canal and powerhouse raceway. To reduce debris collection and as a safety measure, two deflection log booms would be positioned across the raceway entrance. The 100-foot long west side and 170-foot long east side log booms would tie into a sluice gate in order to pass the debris over the weir and avoid blockages. At the east side, a new siphon intake for the East Side Canal would be constructed.

Downstream fish passage across the diversion would be provided along the length via notches in the structure. Adjacent to the water wheel raceway would be an upstream fish passage channel (10 feet wide and approximately 180 feet in length) that would be designed to accommodate fish during low flows (Appendix B). Passive integrated transponder (PIT) tag detectors would be placed at each downstream fish passage notch and at the entrance/exit of the upstream fish passage to sense and record fish movement over and around the diversion. A fish screen would be placed in the East Side Canal near the river, with passage back to the river (Figure 3-4). All concentrated fish passage areas would have PIT tag detectors to estimate population movement and numbers.

Boat passage components (Appendix B) would provide additional debris removal benefits. This notch in the diversion structure would be located at the center of the channel. The boat passage section would consist of a stepped opening 30-feet wide by 2-feet deep in the diversion with a more gradual slope into the tailwater of the diversion to provide safer rafting over the diversion. The boat passage would be lined with concrete and flows could be regulated using a weir at the entrance. The diversion structure itself would be designed with a gradual slope for safe passage over the diversion during passable flows. Boater warning signs would be placed at locations above the diversion on both banks.

The Concept Design Report (Appendix B) offers recommendations for construction means and methods. A cofferdam could be installed upstream of the new structure to allow work to be performed in the dry, and demolition of the existing diversion could possibly take place in two phases for dewatering purposes. This alternative includes the use of cobbles and gravel that have been deposited into the river channel below the diversion and at the confluence of Tusher Wash. This alternative would also require the temporary use of approximately 5.5 acres of BLM-managed public lands, 15.9 acres of state sovereign lands (Green River itself), and 2.3 acres of private lands for staging and access during construction (Figure 3-5).

Refer to Figure 3-2 for Cross-Section of New Diversion

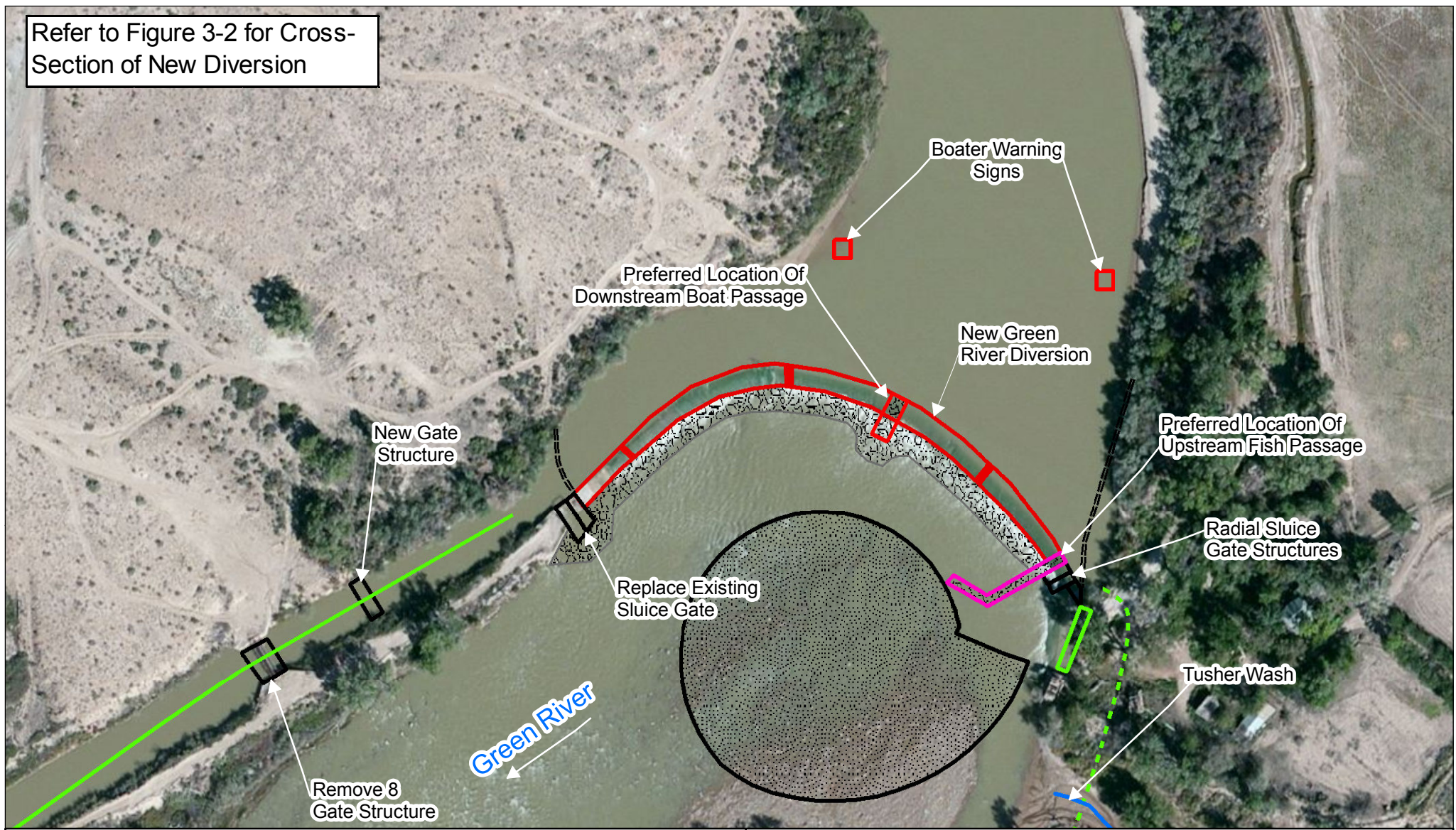
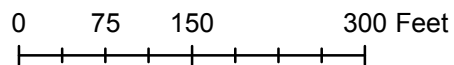


Figure 3-3: Preferred Alternative - Replace In Place With Passages Alternative

NRCS Green River Diversion Rehabilitation
Final EIS



McMILLEN, LLC
DESIGN with Vision. BUILD with Integrity.



Legend

- === Log Boom
- Canal
- Stream
- Boat Passage
- Fish Passage Notches
- Water Wheel Raceway
- ▨ Riprap
- ▨ Proposed Sediment Removal (2.5 acres)
- New Gate
- Upstream Fish Passage
- - - Subsurface Canal

NOTES:
Aerial photo from Bing imagery service. Capture date September 2010. Plan features are approximated and not to scale or defined as final plan.



Figure 3-4: Preferred Alternative Replace in Place With Passages Eastside Canal Component

NRCS Green River Diversion Rehabilitation
Final EIS

0 50 100 200 Feet



McMILLEN, LLC
DESIGN with Vision. BUILD with Integrity



Legend

- Sediment and Fish Return Pipes
- Sediment Sluice/ Fish Barrier Structure
- Canal

NOTES:
Aerial photo from Bing imagery service. Capture date September 2010. Plan features are approximated and not to scale or defined as final plan.

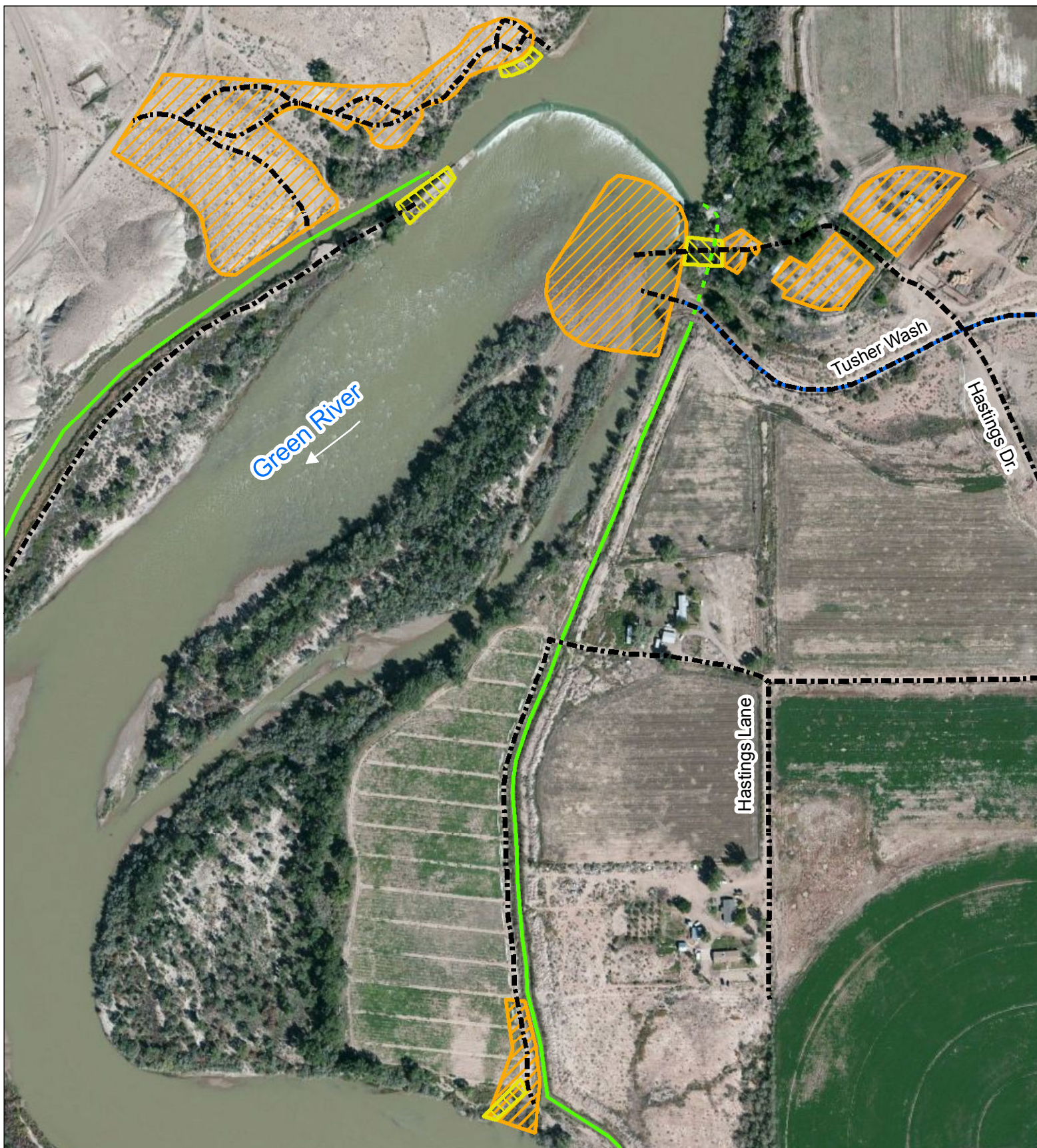


Figure 3-5: Staging and Access

NRCS Green River Diversion Rehabilitation
Final EIS

0 100 200 400 Feet



McMILLEN, LLC
DESIGN with Vision. BUILD with Integrity



Legend

- Site Access
- Canal
- Stream
- Clear and Grub
- Staging

NOTES:
Aerial photo from Bing imagery
service. Capture date September
2010. Plan features are
approximated and not to scale or
defined as final plan.

3.5. Past, Present, and Reasonably Foreseeable Projects

The Gunnison Butte Irrigation and Eastside High Ditch Project is located south of the project area, between the diversion and the city of Green River. The project plans include the diversion of water directly out of the Green River to irrigate about 5,000 acres of new lands that they currently own or have leased, and about 1,500 acres of supplemental irrigation. This will supply established markets with melons, corn, alfalfa, sod and various row crops (State of Utah, 2000). The project is downstream, therefore the water rights are not directly associated with the Green River Diversion Rehabilitation project.

The Upper Colorado River Endangered Fish Recovery Program, through funding from the BOR and technical oversight from the USFWS, is working on a fish exclusion system focused on reducing entrainment and to prevent ESA listed fish and other fish species from entering the Green River Canal. The program and project team are working with the Green River Canal Company and Thayn Hydropower to look at a solution downstream of the Thayn Power Plant in the Green River Canal. The project requires a 50 cfs fish return flow and additional head created from the diversion, which is included in the flow allocations associated with this rehabilitation project.

The City of Green River, through the National Park Service, Rivers, Trails, and Conservation Assistance (RTCA) Program, which provides planning assistance to cities and counties throughout Utah, is overseeing a new study to establish a trail system that will connect residents and tourists to natural, historic, and modern landmarks, highlight recreational areas, promote health awareness, and seek to establish the first water trail in Utah. The future trail system will expand and promote access to the Green River and connect rural assets surrounding the town. This will be done by establishing trails running along the riverbank and throughout town, promoting access to the river and trail through new signage, and develop the first water trail in Utah. Ongoing project updates, renderings, and maps are available by visiting the Epicenter website (<http://ruralandproud.org/tag/green-river-trail-system/>).

Trout Unlimited has goals for the Green River, including obtaining a national listing as a Wild and Scenic River.

The Blue Castle site is located about five miles west-northwest of Green River, Utah in Emery County. Currently this new nuclear power plant is in the licensing phase, which will require significant data collection and analysis spanning five years with costs in the tens of millions. The project plans for application for water rights are unknown at this time.

3.5.1. Cumulative Impact Area

Based on the Reasonably Foreseeable Actions known on the Green River in the area, cumulative impacts are expected to the environment as a result of the proposed project. The cumulative impact area assessed in this report is the reach of the Green River upstream to Swaseys Beach/Boat Ramp and downstream to Green River State Park in Green River (see Figure 2-4).

3.6. Preferred Alternative

In identifying the preferred alternative, NRCS carefully considered the requirements and intent of the EWP program as well as the expected beneficial and adverse environmental consequences of each alternative. The Environmentally Preferable Alternative has been chosen upon completion of the extensive resource analysis (presented in Chapter 4, Environmental Consequences and in the Concept Design Report [Appendix B]) as well as the DEIS Public Comment Period. The Preferred Alternative is the same as the Environmentally Preferable Alternative, and it is the Replace In Place With Passages Alternative.

3.6.1. Mitigation

Mitigation includes all measures undertaken to avoid, minimize, or compensate for potential adverse environmental impacts. BMPs (listed throughout Chapter 4, per resource) would be implemented during construction in an effort to avoid and minimize impact wherever possible. Figure 3-6 proposes the Staging, Access, and Erosion and Sediment Control Plan to be implemented during construction.

Table 3-1. Preferred Alternative – Mitigation Commitments

Resource	Preferred Alternative – Mitigation Commitments
Soils	The project is self-mitigating in that efforts to reduce sediment in the main channel and west raceway will be implemented with the installation of radial gates. The Operation and Maintenance Plan (Chapter 3.6.2) would specify under which conditions the new radial gates at the diversion and the raceway would be activated.
Water Resources – Hydrology	Stream hydrogeology will be further assessed during an independent modeling and final design review exercise, which would add monitoring and documentation procedures to identify unforeseen construction or post-construction impacts.
Waters of U.S. including Wetlands	Coordination with USACE will continue throughout project design to determine if compensatory mitigation would be required for impacts to jurisdictional waters of the U.S., including wetlands. Aquatic resources will be further assessed during an independent modeling and final design review exercise, which would add monitoring and documentation procedures to identify unforeseen construction or post-construction impacts.
Plants – Riparian Zone and Other	All disturbed areas not associated with direct structure repair would be revegetated with approved UDWR plant species. Special precautions would be taken to avoid spreading common reed grass on- or off-site during construction. Methodology for integration of an overall strategy will be formalized into a Post Construction Rehabilitation Plan. Riparian trees will not be removed unless they are non-native and/or specified in the plans. Native seed mixes would have a variety of appropriate species (especially woody species where feasible).

Resource	Preferred Alternative – Mitigation Commitments
Threatened and Endangered Species	<p>All action alternatives would involve temporary impacts to the fish species in the river channel. The Replace In Place With Passages Alternative would provide for upstream and downstream fish passage, as well as PIT tagging to monitor and study fish movement and usage for this reach of the Green River. Fish entrainment in the East Side Canal would also be reduced through the installation of a screen. Further, more specific conservation measures are explained in detail in the Biological Assessment (Appendix C).</p> <p>Mitigation efforts to reduce fish entrainment in the west raceway and radial gates include the preparation of an Operation and Maintenance Plan (Chapter 3.6.2) that would specify under which conditions the new radial gates at the diversion would be activated. These flow conditions would be coordinated with the Recovery Program and UDWR to identify when fish would be expected to be present.</p> <p>Enhancement of passages and installation of monitoring tools for improvement of habitat.</p>
Fish	<p>Project components such as downstream fish passage notches open up the corridor for migration, and PIT tagging would enhance opportunities for monitoring and data collection.</p> <p>Mitigation efforts to reduce fish entrainment in the west raceway and radial gates include the preparation of an Operation and Maintenance Plan (Chapter 3.6.2) that would specify under which conditions the new radial gates at the diversion would be activated.</p>
Wildlife	<p>Habitat disturbed from construction activities would be restored using native plant species. During construction and until the restoration area was fully established, the area would be maintained on a regular basis to prevent the establishment of noxious weeds and invasive plant species.</p> <p>Riparian trees will not be removed unless they are non-native and/or specified in the plans. Native seed mixes having a variety of appropriate species (especially woody species where feasible).</p>
Cultural/Historic	<p>Mitigation of the adverse effects would occur through the development of a treatment plan that is currently being formalized in a Memorandum of Agreement (MOA). If unknown cultural/historical resources were encountered during excavation activities, construction would stop and the appropriate agencies would be notified.</p> <p>The Treatment Plan commits to the following:</p> <ul style="list-style-type: none"> • Supplemental archaeological site documentation • Professional-quality article manuscript for the history of the Tusher Diversion Historic District • National Register of Historic Places Registration for the District • Archaeological monitoring and report • Museum-quality permanent display to be installed in the Green River Archives at the John Wesley Powell Museum in Green River, Utah.

3.6.2. Operation and Maintenance

Operation of the structures includes the administration, management, and performance of non-maintenance actions needed to keep the structures safe and functioning as designed. Maintenance includes performance of work, measuring the recording instrumentation data, preventing deterioration of structures, and repairing damage or replacement of the structure as-needed to prevent failure. Damages to completed structures caused by normal deterioration, droughts, flooding, or vandalism are considered maintenance. Maintenance includes both routine and as-needed measures which include:

- Annual control of woody species on or near the diversion, gate, and passage structures.
- Operating structure gates on a monthly basis to ensure proper performance of the gate.
- Regulating or reducing sluicing flows when necessary.

- Other specific items that will be identified during final design.

Inspection of the structures is necessary to verify that the structures are safe and functioning properly. Inspection reports will be supplied to the NRCS following each inspection. Inspections and the associated reports will assess the following items:

- The adequacy of O&M activities,
- Identify needed O&M work,
- Specify ways of relieving unsafe work or performing other needed work, and
- Set action dates for performing corrective actions.

UDAF, local stakeholders, the Recovery Program, and the State of Utah will be responsible for the operation, maintenance, and future modifications to the structures on private property. A specific O&M Plan will be prepared by the NRCS, UDAF, local stakeholders, the Recovery Program, and the State of Utah that will govern the use of the structures. The specific details of the O&M Plan and agreement will be determined during final design and be entered into by all applicable parties prior to the start of construction activities.

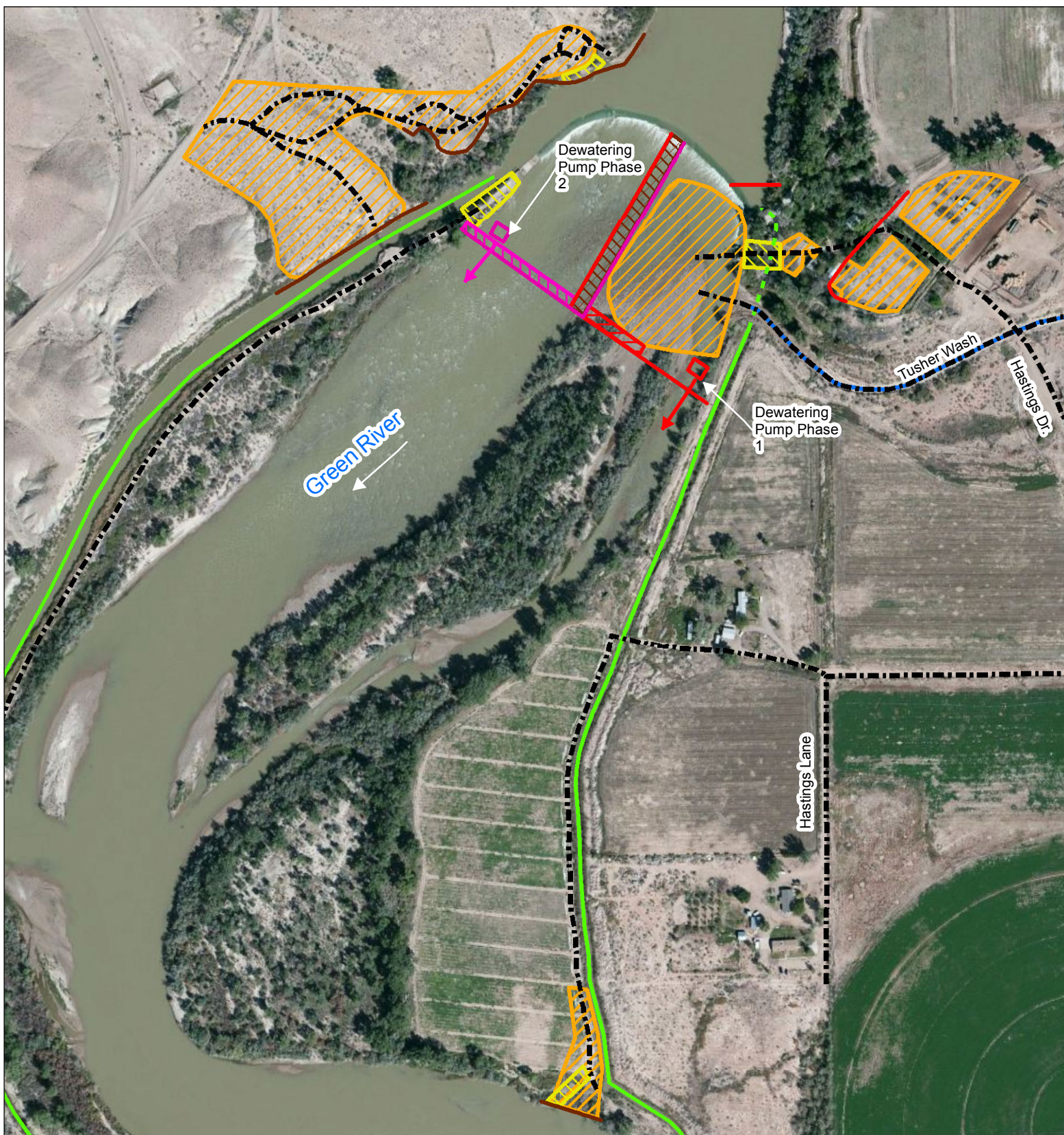


Figure 3-6: Staging, Access and ESC (Preferred Alternative)

NRCS Green River Diversion Rehabilitation

0 150 300 600 Feet



McMILLEN, LLC
DESIGN with Vision. BUILD with Integrity



Legend

- | | | |
|----------------|-------------------|-------------------------------|
| Staging | Access Road | Dewatering Berm Phase 1 |
| Canal | ESC Phase 1 | Dewatering Berm Phase 2 |
| Stream | ESC Phase 2 | Dewatering Berm Phase 1 and 2 |
| Clear and Grub | ESC Phase 1 and 2 | |

NOTES:
Aerial photo from Bing imagery service. Capture date September 2010. Plan features are approximated and not to scale or defined as final plan.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

The purpose of this chapter is to provide a description of how the resources identified would be directly or indirectly and individually or cumulatively affected by the proposed action. The following describes the type of effects and impacts analysis used in this chapter (NRCS 2011). This analysis forms the scientific and environmental basis for the comparisons of alternatives presented in the previous chapter.

Environmental impact of the proposed action and alternatives include, but are not limited to, the following:

- *Direct Effect.* Impacts (or effects) caused by a proposed action and that occur at the same time and place.
- *Indirect Effect.* Impacts (or effects) caused by a proposed action and that appear later in time or farther removed in distance, but still reasonably foreseeable.
- *Cumulative Effect.* This refers to the impact on the environment that results from the incremental effect of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions.
 - Past and present actions may involve construction and agricultural activities at and near the site, soil contamination, downstream sediments, fish and wildlife habitats, and recreation activities. Foreseeable future actions include the possibility of development due to a new nuclear plant in the area and growth in the recreation and tourism industries in Green River (refer to Section 3.5).
 - The assessment of cumulative impacts is not substantially different from the assessment of direct or indirect impacts. The same types of considerations are made to determine the environmental consequences of the alternatives for direct, indirect, or cumulative impacts. Cumulative impact assessment, however, generally entails a broader perspective (or broader scale) such as what else is happening in the area and/or downstream.
- Construction Impacts and BMPs are included where applicable. Some resources would not be temporarily impacted by project construction activities; in those instances, BMPs are not necessary.
- Conflicts with existing land use plans, policies, or controls
 - Unavoidable
 - Short-term and long-term
- Any adverse environmental effects that cannot be avoided if the proposal is implemented
- The relationship between local short-term uses of the human environment and the enhancement of long-term productivity
- Any irreversible or irretrievable commitments of resources that would be involved in the proposed action if implemented

Impacts proposed by the action alternatives would be similar for most resources and are discussed simultaneously. Where there are differences, the alternatives are discussed separately. Table 4-1 provides a summary comparison of the impacts associated with each alternative. The alternatives proposed for consideration and analyzed in detail in this EIS have been compared to discern the merits and disadvantages of each alternative. This information is presented in summary, and further detail is provided in subsequent sections. The chapter concludes with detail on construction activities (where applicable), and a summary of cumulative impacts per resource. Where impacts would be unavoidable, mitigation commitments will be made (a list of mitigation commitments has been presented in Section 3.6.1, Table 3-1).

4.1. Summary and Comparison of Alternatives

Table 4-1. Summary and Comparison of Direct, Indirect, and Short-Term Resource Impacts

Effects	No Action	Replace In Place (Baseline)	Preferred Alternative - Replace In Place With Passages
Soils	<i>Direct Impacts:</i> None <i>Indirect effect</i> - scouring of soil downstream from diversion failure.	<i>Direct Impacts:</i> Approx 1100 cubic yards of cobble and gravel removed from the Tusher Wash deposition area and used to construct and/or support the diversion <i>Short-Term:</i> Potential soil disturbance and sediment into Green River during construction. Temporary disturbance to access roads and staging areas during construction.	<i>Direct Impacts:</i> Approx 1100 cubic yards of cobble and gravel removed from the Tusher Wash deposition area and used to construct and/or support the diversion <i>Short-Term:</i> Potential soil disturbance and sediment into Green River during construction. Temporary disturbance to access roads and staging areas during construction.
Prime and Unique Farmlands	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Temporary Downstream Effects to 4,000 ac of cropland.	<i>Direct Impacts:</i> None <i>Short-Term:</i> Temporary easement for access during const.	<i>Direct Impacts:</i> None <i>Short-Term:</i> Temporary easement for access during const.
Water Resources – Water Quality, Hydrology, Floodplains	<i>Direct Impacts:</i> None <i>Short-Term:</i> Disaster clean-up activities would temporarily affect sediment levels in river channel. Temporary impacts to water rights, indirectly impacting 4,000 acres of irrigated croplands.	<i>Direct Impacts:</i> 0.2 ac of clearing and grubbing in the floodplain. <i>Short-Term:</i> Temp disturbance to river channel. Temp disturbance due to construction access and staging (2.3 ac).	<i>Direct Impacts:</i> 0.2 ac of clearing and grubbing in the floodplain. <i>Short-Term:</i> Temp disturbance to river channel. Temp disturbance due to construction access and staging (2.3 ac).
Waters of US including Wetlands	<i>Direct Impacts:</i> None <i>Indirect effects</i> to streams. Stream channel altered and wetlands washed away or filled with sediment from diversion failure.	<i>Direct Impacts:</i> 1.3 ac impact to open waters and PEM* wetlands. <i>Short-Term:</i> 15.9 ac temporary impact to open waters; 1.9 ac temporary impact to ephemeral stream 0.2 ac temporary impact to wetlands.	<i>Direct Impacts:</i> 1.3 ac impact to open waters and PEM* wetlands <i>Short-Term:</i> 15.9 ac temporary impact to open waters ; 1.9 ac temporary impact to ephemeral stream 0.2 ac temporary impact to wetlands.

Effects	No Action	Replace In Place (Baseline)	Preferred Alternative - Replace In Place With Passages
Climate Change	<i>Direct Impacts:</i> None	<i>Direct Impacts:</i> None	<i>Direct Impacts:</i> None
Air Quality	<i>Direct Impacts:</i> None <i>Indirect and Short-Term:</i> None	<i>Direct Impacts:</i> None <i>Short-Term:</i> Construction activities would temporarily affect air quality in the project area.	<i>Direct Impacts:</i> None <i>Short-Term:</i> Construction activities would temporarily affect air quality in the project area.
Plants – Riparian Zone and Other	<i>Direct Impacts:</i> None <i>Short-Term:</i> Damage to vegetation downstream of diversion from failure.	<i>Direct Impacts:</i> 0.5 ac of impact <i>Short-Term:</i> Potential for additional impact in access and staging areas during construction.	<i>Direct Impacts:</i> 0.5 ac of impact <i>Short-Term:</i> Potential for additional impact in access and staging areas during construction.
Threatened and Endangered Species	<i>Direct Impacts:</i> Obstructed fish passage during low flows. <i>Short-Term:</i> Damage to species and habitat downstream of diversion from failure.	<i>Direct Impacts:</i> 1.3 acres of impact due to new riprap in channel; 0.5 acres of wildlife habitat impacted (riparian) No downstream fish passage. Obstructed fish passage during low flows. No fish or wildlife kills anticipated. <i>Short-Term:</i> 15.9 ac of disturbance to the channel during construction (designated critical habitat).	<i>Direct Impacts:</i> 1.3 ac of impact due to new riprap in channel; no fish or wildlife kills anticipated. 0.5 acres of wildlife habitat impacted (riparian) Enhancement of passages and installation of monitoring tools for improvement of habitat. <i>Short-Term:</i> 15.9 ac of disturbance to the channel during construction (designated critical habitat).
Fish	<i>Direct Impacts:</i> Obstructed fish passage during low flows. <i>Short-Term:</i> Possible destruction or modification of fish habitat in the channel downstream.	<i>Direct Impacts:</i> 1.3 acres of impact due to new riprap in channel; Obstructed fish passage during low flows. <i>Short-Term:</i> 15.9 ac of disturbance to the channel during construction	<i>Direct Impacts:</i> 1.3 acres of impact due to new riprap in channel; <i>Short-Term:</i> 15.9 ac of disturbance to the channel during construction
Wildlife	<i>Direct Impacts:</i> None <i>Short-Term:</i> Injury or fatality, as well as extreme habitat modifications, in the inundation area from diversion failure.	<i>Direct Impacts:</i> 0.5 acres of wildlife habitat impacted (riparian) <i>Short-Term:</i> Temp disturbance to project area	<i>Direct Impacts:</i> 0.5 acres of wildlife habitat impacted (riparian) <i>Short-Term:</i> Temp disturbance to project area
Socioeconomics	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Adverse effects damage to roads, access and property damages; loss of crops and jobs during floods. Temporary Downstream Effects to 4,000 ac of cropland.	<i>Direct Impacts:</i> None Alternative beneficial in the provision of a more reliable supply of water for irrigation and hydropower. <i>Short-Term:</i> Job creation during construction.	<i>Direct Impacts:</i> None. Alternative beneficial in the provision of a more reliable supply of water for irrigation and hydropower. <i>Indirect:</i> Possible increase in tourism, economy in the vicinity due to provision of boat passage. <i>Short-Term:</i> Job creation during construction.

Effects	No Action	Replace In Place (Baseline)	Preferred Alternative - Replace In Place With Passages
Cultural/Historic	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> historic diversion structure would be adversely affected.	<i>Direct Impacts:</i> Structure demolition and E Side Canal improvements a significant adverse effect. <i>Short-Term:</i> Construction activities, staging of equipment and materials, and river access temp impacts to eligible sites. Mitigate adverse effects through the development of a treatment plan formalized in the Memorandum of Agreement (MOA).	<i>Direct Impacts:</i> Structure demolition and E Side Canal improvements a significant adverse effect. <i>Short-Term:</i> Construction activities, staging of equipment and materials, and river access temp impacts to eligible sites. Mitigate adverse effects through the development of a treatment plan formalized in the Memorandum of Agreement (MOA).
Recreation/Public Health & Safety	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> High hazard and loss-of-life potential in the event of diversion failure.	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Reduction of loss-of-life potential.	<i>Direct Impacts:</i> Enhanced recreation opportunities for the boating community due to provision for boat passage. <i>Indirect and/or Short-Term:</i> Reduction of loss-of-life potential.
Visual Quality/Aesthetics/Scenic Beauty	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Disaster clean-up in the area would degrade the area temporarily.	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Construction site would degrade the area temporarily.	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Construction site would degrade the area temporarily.
Land Use/Rights	<i>Direct Impacts:</i> None <i>Short Term:</i> Temporary Downstream Effects to 4,000 ac of cropland.	<i>Direct Impacts:</i> None <i>Short-Term:</i> Temporary easement (approx.5.5 ac.) for BLM access during const. Special Use Lease (State of Utah) – 15.9 ac (temp. construction); 1.3 ac permanent easement.	<i>Direct Impacts:</i> None <i>Short-Term:</i> Temporary easement (approx.5.5 ac.) for BLM access during const. Special Use Lease (State of Utah) – 15.9 ac (temp. construction); 1.3 ac permanent easement.
Infrastructure - Transportation	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Adverse effects from damage to roads from a diversion failure. Loss of access during floods.	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Temporary affects to road during construction	<i>Direct Impacts:</i> None <i>Indirect and/or Short-Term:</i> Temporary affects to road during construction

*PEM = Palustrine Emergent wetlands

4.2. Soil Resources

4.2.1. Geology, Stream Bank Erosion, and Sedimentation

4.2.1.1. *No Action Alternative*

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would not change existing conditions with regard to geology, erosion and sedimentation at the diversion. The diversion would be left in its current condition, and sediment would continue to accumulate within the upstream pool area.

In the event of a diversion failure, this alternative would have an indirect impact on erosion and sedimentation within the Green River drainage downstream; soils that have settled into the river bottom would potentially be washed downstream from the high volumes of water exiting the diversion structure. Sedimentation in the Green River would increase as these soils would settle out of the water column in slower velocity areas covering existing stream, riparian, and wildlife habitat.

In the event of diversion failure, scouring in the channel below the diversion would occur. The extent of channel scour would be dependent upon how badly the diversion failed. A complete failure of the diversion could result in appreciable erosion of the Green River channel as well as clearing of the majority of vegetation in the flow path immediately downstream. Streambank erosion would potentially increase with minimal riparian vegetation.

4.2.1.2. *Replace In Place Alternative*

DIRECT AND INDIRECT IMPACTS

The sediment deposits upstream of the diversion would be directly impacted by any of the action alternatives. This alternative does not provide for additional sediment sluicing, however one existing sluice/water control gate would transport sediment from the bottom of the river downstream, helping to keep the raceway and irrigation canals clean. Direct impacts to soil would also be associated with erosion along streambanks in disturbed areas. Best Management Practices (BMPs) will be implemented during construction to minimize impacts to banks and these practices are listed below. The proposed action would not have an indirect impact on soil or geologic resources.

4.2.1.3. *Preferred Alternative - Replace In Place With Passages*

DIRECT AND INDIRECT IMPACTS

The sediment deposits upstream of the diversion would be directly impacted by any of the action alternatives. The installation of sediment sluice gates would transport sediment in the bottom of the river downstream helping to keep the raceway and irrigation canals clean. Direct impacts to soil would also be associated with erosion along streambanks in disturbed areas. Best Management Practices (BMPs) will be implemented during construction to minimize impacts to banks and these practices are listed below. The proposed action would not have an indirect impact on soil or geologic resources.

CONSTRUCTION IMPACTS AND BMPs

BMPs aim to minimize the transport and deposition of sediment in the area during construction. Soils dredged from the large deposition area where Tusher Wash meets the Green River would be utilized to provide structural fill wherever possible. The soils would be separated and filtered for appropriate size and composition of material, with the top layer of sediment discarded due to the high density of fine material. This would amount to approximately 1100 cubic yards of cobble and gravel removed from the deposition area and possibly used to construct and/or support the diversion.

Impacts to soils in staging areas and along access roads would be temporary during construction. Approximately 2.3 acres on the east and 5.5 acres on the west banks will be temporarily disturbed. Figure 3-6 proposes the Staging, Access, and Erosion and Sediment Control Plan to be implemented during construction.

Short-term construction impacts would include bank erosion until vegetation was established. BMPs including but not limited to, the following would be implemented during construction to minimize these impacts.

- Rock riprap would be placed upstream of the diversion.
- Water bodies adjacent to construction and staging areas will be identified, and such measures as straw bales, silt fences, and other appropriate sediment control BMPs would be implemented to prevent the entry of sediment and other contaminants into waters.

Following construction, all sediment control BMPs will be removed along with any accumulated sediment and disposed of in an off-site location at the appropriate time.

4.2.2. Prime and Unique Farmlands

There are farmlands of statewide importance in the project vicinity. The Redbank-Flatnose Families Association soils are found immediately adjacent to the existing structure and downstream along the East Side Canal.

4.2.2.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would have no direct impact on the farmland soils of statewide importance in the area. In the event of a diversion failure, this alternative would have an indirect impact on farmlands due to excess sediment washing downstream, potentially settling into areas along the banks of the East Side Canal.

4.2.2.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

Direct impacts to prime and unique farmlands would primarily be associated with erosion along stream banks immediately downstream of the diversion. The proposed action would not involve the acquisition of private property that is used for agricultural production and would not be expected to induce further stream bank erosion that could alter prime and unique farmland. The proposed action will not indirectly impact prime and unique farmlands in the project area.

CONSTRUCTION IMPACTS AND BMPs

All alternatives involve stream bank stabilization components such as riprap. This type of BMP will be implemented during construction to avoid or minimize impact to the banks upstream of the diversion.

Temporary staging of equipment and access along existing roads and on area properties would require impacts to those soils deemed prime and unique for farming. However, these areas proposed for staging and access are not currently irrigated; therefore any temporary impact during construction would not alter any existing farmland designation.

4.3. Water Resources

Activities related to water resources are regulated by EPA, the U.S. Army Corps of Engineers (USACE), and the Utah Department of Environmental Quality (UDEQ). Appropriate permits will need to be obtained for any activities regulated by the Clean Water Act (CWA), and include the following:

- Section 404 Permit: for discharge of fill into waters of the US (jurisdictional wetlands)
- Section 401 Water Quality Certification: certification for activity that is subject to authorization under Section 404 of the CWA
- Section 402 of the CWA for construction activities: National Pollutant Discharge Elimination System (NPDES) permit (for construction over 1 acre), as administered by the Utah Pollutant Discharge Elimination System (UPDES)
- Stream alteration permits: required for any work in or near streams in the State of Utah

Coordination with participating agencies is ongoing. Specific area management plans may exist that the project will need to comply with to meet the requirements set forth as part of those plans.

4.3.1. Water Quality**4.3.1.1. No Action Alternative****DIRECT AND INDIRECT IMPACTS**

The No Action Alternative would have no direct impact on the water quality of the Green River. Existing conditions would remain as they are currently.

In the event of a diversion failure, this alternative would have an indirect impact on water quality due to excess sediment washing downstream, potentially settling into areas along the banks of the East Side Canal. In this event, a large volume of water and stored sediment would flow downstream over a short period of time. The water quality in the river would be degraded from fill material, upland soils, and destruction of vegetation, violating federal and state water quality rules and regulations.

Indirect effects would include bed and bank erosion to the river channel and to the East Side and Green River canals from gradual erosion until the banks became stabilized over time.

4.3.1.2. *Proposed Action – All Alternatives*

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

Rehabilitating, including repairing or replacing, the diversion would not alter surface water quality or increase sedimentation at the site.

The water quality in the project area is not currently listed as “impaired” and meets most beneficial uses. The proposed action would not alter the water quality of this segment of the Green River. The proposed action would have no indirect impact on the water quality of the Green River.

CONSTRUCTION IMPACTS AND BMPs

During construction activities, water quality of the Green River could be impacted due to an accumulation of sediment; however, implementation of construction BMPs would minimize this potential. Further, increases in runoff would not be expected to result in changes to the total maximum daily load (TMDL) for sediment. Construction projects are required to have storm water permits and also to address storm water and sediment management as part of local and state ordinances and regulations.

Erosion control and sediment removal are very important temporary and permanent design considerations because soils within the project area are highly susceptible to erosion in certain locations. Aggressive temporary erosion control and sediment removal measures would need to be implemented during construction until permanent slope stabilization and water quality improvement facilities were constructed.

Project design elements, including BMPs, would be used and would be implemented to reduce the quantity of sediment (1) entering the Green River Canal, Thayne Powerhouse raceway, East Side Canal, and the Hastings Ranch; and (2) flowing downstream and violating any federal or state water quality rules and regulations. The diversion rehabilitation would also meet UPDES and Utah antidegradation requirements. Construction BMPs would include, but are not limited to, the following:

1. A Utah Pollutant Discharge Elimination System permit will be required for all stormwater runoff generated by the project if the project disturbs more than one acre of ground. The project will abide by all applicable permit requirements and state laws for stormwater discharge. A construction SWPPP will be developed for the project.
2. Best management practices (BMPs) will be used to limit the release of fine sediment into the Green River during construction in areas adjacent to the river. BMPs include the use of silt-free fill, riprap (if used for rock slope protection), and silt barriers.
3. Riprap sections will be built and/or reconstructed such that: 1) all potential interstitial spaces are filled with sediment up to the corresponding water level for a 5-year flood event; 2) cutoff walls are installed in riprap sections to limit fresh water flow; and 3) as appropriate, rocks in gabion baskets are covered with geotextile fabric to prevent entry by nonnative fish. These measures will be specified in any Project-related construction plans and any deviation from use of these measures will be approved by the USFWS. Riparian vegetation will also be installed at the foot or toe of newly placed riprap structures.
4. Bank stabilization and erosion-control structures will be designed to maintain or enhance natural stream function (sinuosity, gradient, hydrology, and sediment transport). Stabilization structures will be defined during the Clean Water Act Section 404 permitting process with the U.S. Army Corps of Engineers.
5. Materials will not be stockpiled immediately adjacent to the river channel.

4.3.2. Hydrology

Both action alternatives propose to level the crest elevation to its original design elevation, which ensures water delivery to water users. Project stakeholders have expressed concern that the project design will exacerbate upstream flooding. For this reason, the 100-year discharge (48,170 cfs) was used in hydraulic simulations of the alternatives in order to ensure that the final concept design does not increase upstream flooding. This will be a requirement of the Preferred Alternative as well.

4.3.2.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would have no direct impact on hydrology. In the event of a diversion failure, this alternative would have an indirect impact on hydrology. Excess flows would travel downstream and potentially flood properties downstream.

4.3.2.2. Replace In Place Alternative

DIRECT AND INDIRECT IMPACTS

Rehabilitating or replacing the diversion without the proposed design components that provide for fish and boat passage would have a net impact on the hydrology of the Green River. It is possible that at certain times of the year the gates at the west raceway and the west end of the diversion would be closed, creating temporary upstream flooding.

4.3.2.3. Preferred Alternative - Replace In Place With Passages

DIRECT AND INDIRECT IMPACTS

Rehabilitating or replacing the diversion with the proposed design components would have no net impact on the hydrology of the Green River. The Concept Design Report (Appendix B) includes a hydrologic analysis of the action alternatives which concludes that the action alternatives would result in no change to the flow of the Green River.

CONSTRUCTION IMPACTS AND BMPs

Flows in the river would be temporarily altered to accommodate construction activities in the channel. Construction means and methods would be determined during the final design of the project; however, the Concept Design Report (Appendix B, Sheets GC003 and GC005) does include general recommended Construction Phasing and Dewatering Plans, which show the potential use of berms, dewatering bladders and pumps.

4.3.3. Water Rights

The Concept Design Report (Appendix B) indicates that the large variations in flows observed at the Green River Diversion make it important that the project alternatives satisfy a range of water demands over as broad a range of flows as possible. The hydrologic analysis in the report concludes that the demands at the diversion will be met.

4.3.3.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would have direct impacts to the water rights associated with the diversion, as the existing structure currently does not guarantee delivery. This alternative would indirectly impact all water rights from the total loss of water delivery if the diversion failed and potentially hinder the function of irrigation canals, threatening the loss of irrigation water for 4,000 acres of cropland.

4.3.3.2. Replace In Place Alternative

DIRECT AND INDIRECT IMPACTS

This alternative would provide the same level of service to the existing water right holders, and therefore would have no direct or indirect impact on water rights.

CONSTRUCTION IMPACTS AND BMPs

Water rights may be temporarily impacted during project construction, however the project commitment to the water users includes the following (from the Concept Design):

- Deliver 773 cfs from April to October to Green River Canal and raceway.
- Deliver 650 cfs from November to March to Green River Canal and raceway.
- Schedule temporary flow shutdowns in winter to avoid impacts to hydropower production.

- Deliver 65 cfs April to October to Hastings Ranch pump station.
- Deliver 31 cfs April to October to the East Side Canal siphon.

4.3.3.3. Preferred Alternative - Replace In Place With Passages

DIRECT AND INDIRECT IMPACTS

This alternative would provide the same level of service to the existing water right holders and adds fish and boat passage as well. The overall demand to be met at the Green River Diversion for this alternative includes water allocation for water rights holders, fish bypass in the hydropower raceway or Green River Canal, sediment sluicing, boat passage, upstream fish passage, and downstream fish passage. The estimated demand from perfected water rights at the Green River Diversion is 819 cfs, and therefore the total water demand at the diversion structure for this alternative is 1,106 cfs. Table 4-2 lists the water demands at the diversion with the implementation of this alternative. Due to the available flows (see Section 2.2.2) this alternative would have no direct or indirect impact on water rights.

Table 4-2. Water Demands - Replace In Place With Passages Alternative

Use	Demand (cfs)
Water Rights Holders	819
Fish Bypass – Green River Canal	50
Fish Bypass – East Side Canal	20
Upstream Fish Passage	30
Downstream Fish Passage	40
Boat Passage	147
TOTAL	1,106

The Hydrology Memo in the Concept Design Report (Appendix B) concludes that flow rates during the growing season from April 1 through October 31 at the diversion structure required to meet the demands associated with this project (1,106 cfs) have been met every day since 2006.

CONSTRUCTION IMPACTS AND BMPs

Water rights may be temporarily impacted during project construction, however the project commitment to the water users includes the following (from the Concept Design):

- Deliver 773 cfs from April to October to Green River Canal and raceway.
- Deliver 650 cfs from November to March to Green River Canal and raceway.
- Schedule temporary flow shutdowns in winter to avoid impacts to hydropower production.
- Deliver 65 cfs April to October to Hastings Ranch pump station.
- Deliver 31 cfs April to October to the East Side Canal siphon.

4.3.4. Groundwater

4.3.4.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would have no impact on the existing groundwater supply and levels at the project site. This alternative would have an indirect impact on groundwater levels and/or quality downstream in the event of diversion failure, due to the potential for inundation of low-lying areas in the floodplain.

4.3.4.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

The action alternatives would have no direct impacts on groundwater. The action alternatives would have no indirect impacts on groundwater. The Concept Design Report (Appendix B) analyzed the potential project impacts on groundwater, with negligible results for all alternatives.

CONSTRUCTION IMPACTS AND BMPs

General construction impacts that could occur include potential impacts from contaminated soil or groundwater. There is also the potential impact to the environment from the release of a hazardous material brought on-site during construction activities. NRCS requires that contractors comply with all federal, state, and local laws and regulations pertaining to pollution and contamination of the environment to prevent pollution of surface water, groundwater, soil, and air with any hazardous materials.

4.3.5. Floodplains

A Floodplain Development Permit would be required by Emery and Grand counties.

4.3.5.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would not result in direct changes to the function of the 100-year floodplain nor would it incur further impact on the floodplain. The No Action Alternative would potentially result in changes to the function of the existing floodplain in the event of diversion failure. Over the short-term, this alternative would likely result in an increased flood hazard. Properties within Green River floodplain downstream of the diversion structure would potentially experience high volumes of water exiting the diversion structure and dispersing into the floodplain.

4.3.5.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

Hydraulic analyses for impacts to floodplains and the results are presented in the Conceptual Design Report (Appendix B). Upstream of the diversion location the model output shows slight differences in the flood elevation with the implementation of this alternative. Analysis resulted in the difference in water depth between existing conditions and both action alternatives to be negligible.

The sediment deposition area at Tusher Wash is currently located in the floodplain of the river and only gets inundated during high water events. It is not currently classified as suitable habitat for fish nursery since it is dry for a good portion of the year. Excavation of the sediment would create additional open water during low flows increasing fish nursery habitat.

CONSTRUCTION IMPACTS AND BMPs

Construction activities could cause an increase in erosion/sedimentation due to clearing and grading. Potential temporary effects include construction impacts to water quality, wetlands and floodplain encroachments along the river and at the canals and laterals in the study area. These potential impacts would be minimized through the implementation of a SWPPP and incorporation of BMPs into the final project design. Figure 3-6 proposes the Staging, Access, and Erosion and Sediment Control Plan to be implemented during construction. Figure 4-1 shows the proposed staging and access areas in the floodplain, resulting in a temporary impact to 2.3 acres due to construction activities occurring in the floodplain.

4.3.6. Waters of the U.S. and Wetlands

Waters of the U.S., including wetlands, have been assessed in accordance with the 1987 USACE Wetlands Delineation Manual and the 2008 Arid West Regional Supplement. The Waters of the U.S. and Wetlands Delineation Report is provided in Appendix C. The report describes the jurisdictional and non-jurisdictional waters of the U.S. and wetlands in the project area, and provides further detail on each open water and wetland in the project area. Table 4-2 summarizes and provides a comparison of the impacts described below for each alternative.

USACE and the Utah Division of Water Resources (UDWRe) will be provided copies of the Joint Application for Permit for comment and approval. Nationwide Permit 3 will be used due to the maintenance aspect of the project, and USACE Sacramento District Regional General Permit 40 has been issued to facilitate efficient Department of the Army permit processing for minimal impact projects that are beneficial to the recovery of the Upper Colorado River endangered fish species. All necessary permits must be obtained prior to commencement of emergency EWP program actions.

4.3.6.1. **No Action Alternative**

The No Action Alternative would not impact waters of the U.S. or wetlands.

4.3.6.2. **Proposed Action – All Alternatives**

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

Based on preliminary project plans, approximately 1.3 acres of open waters (Green River) would be directly impacted by either action alternative due to the placement of the new diversion structure and radial gates. This impact is essentially already existing, however because structures will be placed in the channel this is accounting for that area. Approximately 70 square feet of Palustrine emergent wetland would be directly impacted during clearing and grubbing, in order to gain access during construction. The impacts identified are all associated with jurisdictional waters of the U.S. and wetlands.

Indirect impacts to wetlands would include potential sediment deposition from construction activities. However, because there will be no net loss of wetlands, no indirect net loss of wetlands is expected to occur.

Table 4-3. Summary of Impacts to Waters of the U.S., including Wetlands

Resource	Alternatives	Description of Consequence	Specific Resource Impacted Location and Acreage
WATERS OF THE U.S., INCLUDING WETLANDS	No Action	None.	No Effect
	Replace In Place	Potential impact to waters of the U.S. and wetlands	1.3 ac. of Open Waters will be impacted by this alternative. 70 sq ft of Palustrine Emergent Wetland will be impacted by this alternative.
	Replace In Place With Passages	Potential impact to waters of the U.S. and wetlands	1.3 ac. of Open Waters will be impacted by this alternative. 70 sq ft of Palustrine Emergent Wetland will be impacted by this alternative.

CONSTRUCTION IMPACTS AND BMPs

The action alternatives would temporarily impact the channel of the Green River. Approximately 15.9 acres of the channel are located within the estimated project footprint. Another 1.9 acres is associated with potential temporary impacts to Tusher Wash, an ephemeral stream.

Figure 4-1 shows the potential impacts proposed by the action alternatives. Temporary impacts to open water would include the river channel area that would be potentially “de-watered” during construction (15.9 acres) along with potential temporary disturbance to Tusher Wash (1.9 acres). The delineation

identified emergent wetlands on the east and west banks that would be temporarily impacted during construction (0.2 acres).

Construction activities could cause an increase in erosion/sedimentation due to clearing and grading. Potential temporary effects include construction impacts to water quality, wetlands and floodplain encroachments along the river and at the canals and laterals in the study area. These potential impacts would be minimized through the implementation of a SWPPP and incorporation of BMPs into the final project design.

4.3.7. Climate Change

4.3.7.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

Climate change in Utah is resulting in declining snowpack and an increase in droughts. The No Action Alternative would have no direct impact on climate change. Direct effects from the reduction in precipitation in the watershed would result in a lower risk for high volumes of water to flow through the river. No indirect effects would be anticipated from climate change.

4.3.7.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

All alternatives of the proposed action would allow the diversion to remain in the same general location, keeping the water level of the Green River at what it is currently. Direct effects from the reduction in precipitation in the watershed would result in a lower risk for flood volumes of water to flow through the river.

If streamflow were to decline by 20%, according to conservative estimates, then there would still be 29% of the existing allocation that could be accounted for by evaporative losses and increases in demand over the project life. Furthermore, even if this 29% were perfected or otherwise used up over the project life, the existing water rights holders would still have priority over future water rights holders. Additionally, the flows through the project reach are in part regulated and protected by the Record of Decision (ROD) of the Final Environmental Impact Statement for the Operation of Flaming Gorge Dam (USBR 2006). Therefore, it is not a reasonably foreseeable consequence of current climate projections that the existing project stakeholders—including irrigators, power generators, recreational boaters, fish, and others—would face water shortages due to climate change.

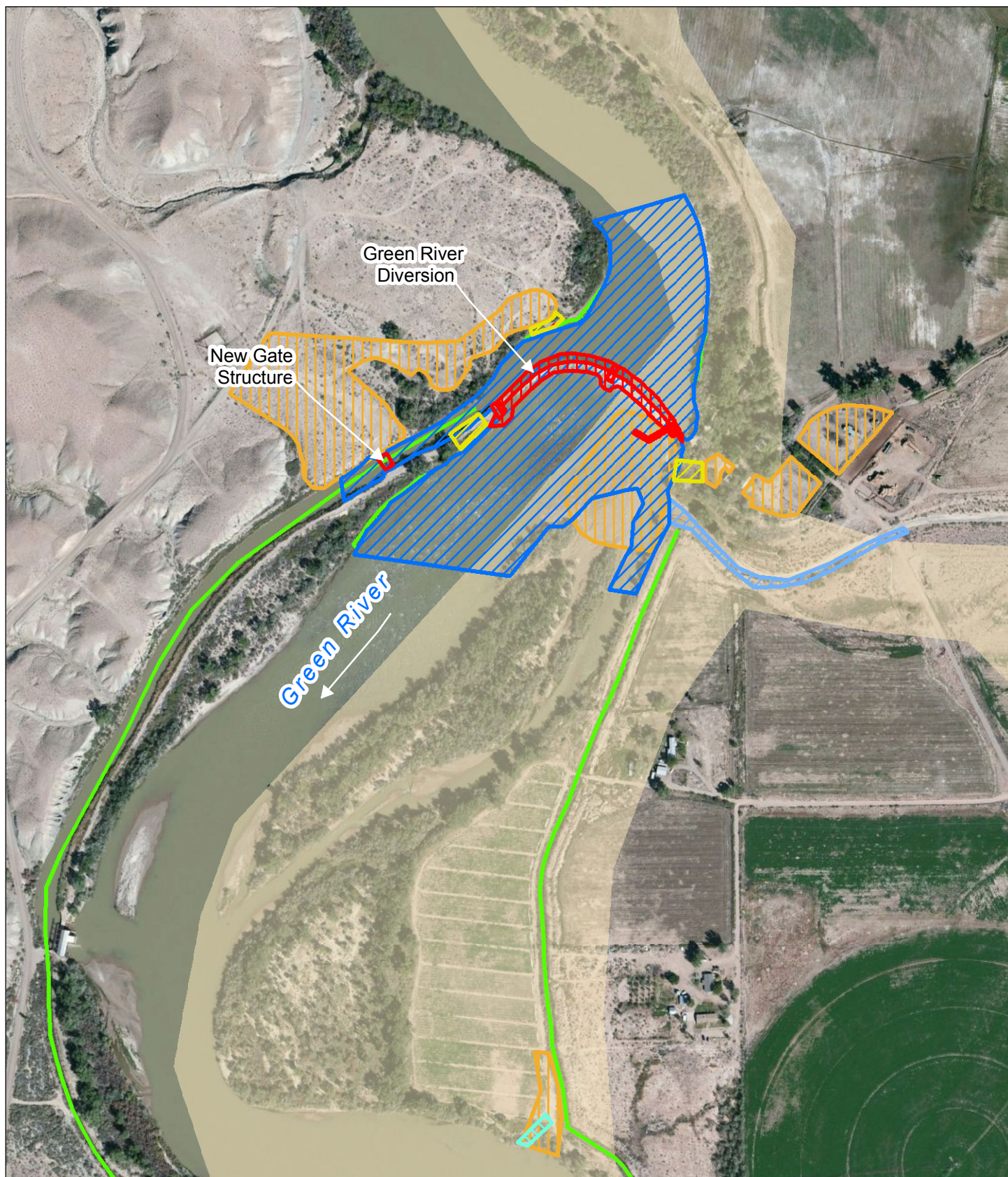


Figure 4-1: Impacts to Waters of the US Including Wetlands

NRCS Green River Diversion Rehabilitation
Final EIS

0 250 500 1,000 Feet

McMILLEN, LLC
DESIGN with Vision. BUILD with Integrity



Legend

- Temporary Impacts to East Side Canal (0.1 ac)
- Permanent Impacts to Open Water & Wetlands (1.3 Acres)
- Temporary Impacts to Open Water (15.9 ac)
- Temporary Impacts to Tusher Wash (0.6 ac)
- Temporary Impacts to Delineated Wetlands (0.2 Acres)

NOTES:
Aerial photo from Bing
imagery service.
Capture date September
2010. Wetland data from
USFWS wetland
inventory. Floodplain
data provided by DEMA
for Grand County only.

4.4. Air Quality

4.4.1.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would not directly or indirectly impact air quality because no construction would take place.

4.4.1.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

Direct and indirect impacts to air quality in the vicinity of the project would not be anticipated.

CONSTRUCTION IMPACTS AND BMPs

Construction activities would temporarily emit several air pollutants. PM₁₀ emissions are associated with the dust created from demolition, land clearing, ground excavation, cut-and-fill operations, and road construction. All other pollutants (PM_{2.5}, CO, SO_x, NO_x, MSAT, and GHG) are generated from heavy-duty diesel engines used by the construction equipment. Construction emissions are greatest during the earthwork phases because of the dust associated with this activity. Fugitive dust can also be produced by winds blowing through the construction site and by trucks carrying uncovered loads. Additionally, mud tracked out onto paved roads leading to and from the construction site creates a source of fugitive dust (i.e., road dust) after it dries.

Emissions from trucks and construction equipment powered by heavy duty diesel engines would be temporary and concentrated around the construction site. Delays associated with travel through construction zones would increase emissions from on-road vehicles. However, these temporary delays would likely only result in a small amount of additional pollutant emissions when compared with the usual traffic experienced around the construction site.

UDEQ requires the control of fugitive dust from all construction sites. Fugitive dust, Mobile Air Source Toxics (MSAT), and GHG emissions increases associated with construction would be minimized by implementation of applicable BMPs. These include the following:

- Spraying the soil on-site with water, or other similar approved dust suppressant/soil binder.
- Wetting materials hauled in trucks, providing adequate freeboard (space from the top of the material to the top of the truck), or covering loads to reduce emissions during material transportation/handling.
- Providing wheel washers, or similar BMP, at construction site accesses to reduce track-out of site materials onto the adjacent roadway network.

- Removing tracked-out materials deposited onto adjacent roadways.
- Wetting material stockpiles to prevent wind-blown emissions.
- Establishing vegetative cover on bare ground as soon as possible after grading to reduce wind-blown dust.
- Requiring appropriate emission-control devices on all construction equipment.
- Requiring the use of cleaner burning fuels.
- Using only properly operating, well-maintained construction equipment.

4.5. Plants

This section describes the impacts of the proposed action on the plant resources in the project area.

Necessary consultation will be performed as required by Section 7 of the ESA and related NRCS guidelines if ESA listed plants are present in the project area. Section 7(a)(2) of the ESA requires that all federal agencies ensure that their actions to authorize, permit, or fund a project do not jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of critical habitat of listed species.

The study area and the Green River Diversion are located at approximately 4,090 feet elevation. The majority of the listed plant species occur at higher elevations than the study area. Furthermore, the listed plant species have very specific soils which they occur on, none of which occur within the study area. The majority of the listed species are found in soil formations that occur within the San Rafael Swell which is southeast of the study area. Based on these facts, no ESA-listed plant species are expected to occur within the Green River Diversion project area and thus there will be no impacts as a result of the project.

4.5.1. Vegetation and Riparian Communities

4.5.1.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would not impact specific vegetation communities nor would it impact the riparian communities in the project area. In the event of diversion failure, indirect impacts to specific plant communities would occur, generally associated with erosion and ground disturbance on the east and west banks of the river.

4.5.1.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

The action alternatives would disturb and/or remove small amounts of trees, shrubs and grasses on the east and west banks of the river. The typical vegetation community within the impacted area consists of wetland grasses, kochia, Russian olive, wild rose, tamarisk, and some willows, cottonwoods along the banks and within the riparian fringe of the river. Vegetation would be permanently cleared to account for the larger gate structures, a new west side gate and structure, and the rehabilitation of the existing gate on the west side. The action alternatives would impact areas within the riparian fringe along the banks of the river. Table 4-4 shows each alternative and the direct (and/or indirect) impacts to the riparian plant community. The slight change proposed to the water surface elevation upstream of the diversion would not have an impact on the vegetation on the east and west banks.

Table 4-4. Summary of Impacts to Plant Communities

Resource	Alternatives	Description of Consequences	Specific Resource Impacted Locations and Acreage
PLANTS – RIPARIAN ZONE	No Action	None.	No Effect
	Replace In Place	Loss of riparian vegetation	Clearing and Grubbing, Tree Removal = 0.5 ac.
	Replace In Place With Passages	Loss of riparian vegetation	Clearing and Grubbing, Tree Removal = 0.5 ac.

CONSTRUCTION IMPACTS AND BMPs

Approximately 7.8 acres of bare ground, existing road/drive way, and native vegetation disturbed from construction activities would be restored using native plant species. During construction and until the restoration area was fully established, the area would be maintained on a regular basis to prevent the establishment of noxious weeds and invasive plant species. Non-desirable plant species would be controlled by cleaning equipment prior to delivery to the project site, eradicating these species before the start and during construction as discovered, and routine monitoring would take place after construction completion. The following BMPs will be implemented:

- Construction activities will be confined to previously disturbed areas where possible for such activities as work, staging, and storage; waste areas; and vehicle and equipment parking areas. Vegetation disturbance should be minimized as much as possible;
- All disturbed areas resulting from the project will be smoothed, shaped, contoured, and rehabilitated to as near their pre-project construction condition as practicable. After completion of the construction and restoration activities, disturbed areas will be seeded at appropriate times with weed-free, native seed mixes having a variety of appropriate species (especially woody species where feasible) to help hold the soil around structures, prevent excessive erosion, and to help maintain other riverine and riparian functions. The composition of seed mixes will be coordinated with wildlife habitat specialists. Weed control on all disturbed areas will be required.
- Successful revegetation efforts must be monitored and reported along with photos of the completed project.
- Riparian trees will not be removed unless they are non-native and/or specified in the plans.

4.5.2. Endangered and Threatened Species and Species of Concern - Plants

4.5.2.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would not impact the threatened or endangered plant species that occur within Emery and Grand counties.

4.5.2.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

The proposed action would not impact the threatened or endangered plant species that occur within Emery and Grand counties. The Biological Assessment (included in Appendix C) has concluded that the project would have No Effect on the listed species or their critical habitats.

The following threatened, endangered, candidate, or proposed species were identified on both of the County USFWS ESA lists, but were not identified as species that should be considered in an effects analysis, according to the USFWS IPaC Preliminary Species List. The proposed project would have No Effect to these species or their critical habitat as they were not included in the USFWS IPaC Preliminary Species List. Additional research has resulted in a conclusion that these species and critical habitat are not located within or near the project area.

- Jones Cycladenia (*Cycladenia humilis* var. *jonesii*)
- Maguire daisy (*Erigeron maguirei*)
- Wright fishhook cactus (*Sclerocactus wrightiae*)
- Last Chance townsendia (*Townsendia aprica*)
- San Rafael cactus (*Pediocactus despainii*)
- Winkler cactus (*Pediocactus winkleri*) and
- Barneby reed-mustard (*Schoenocrambe barnebyi*)

4.5.3. Invasive Plant Species and Noxious Weeds

The project area is in a location where invasive plant species and noxious weeds are known to occur or where risk of an invasion exists. A disturbed area, such as a construction site with access roads, would be considered an area at risk.

4.5.3.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would not change the land use or existing diversion structure; therefore, this alternative would not put the project area at risk by introducing invasive plant species and noxious weeds during construction.

4.5.3.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

All alternatives would put the project area at risk for future invasion of noxious weeds. Construction BMPs (listed in Section 4.8) would be implemented to minimize the short-term impacts associated with ground disturbance. Long-term negative impacts will be managed with re-planting, and various methods of weed control.

CONSTRUCTION IMPACTS AND BMPs

During construction activities, area roads would be utilized by trucks and equipment to access the site; however, implementation of construction BMPs would minimize the potential for transport of invasive plant species and noxious weeds into the area. During construction and until the restoration area is fully established, it would be maintained on a regular basis to prevent the establishment of noxious weeds and invasive plant species. Non-desirable plant species would be controlled by cleaning equipment prior to delivery to the project site, eradicating them before the start and during construction as discovered, and routine monitoring after construction completion.

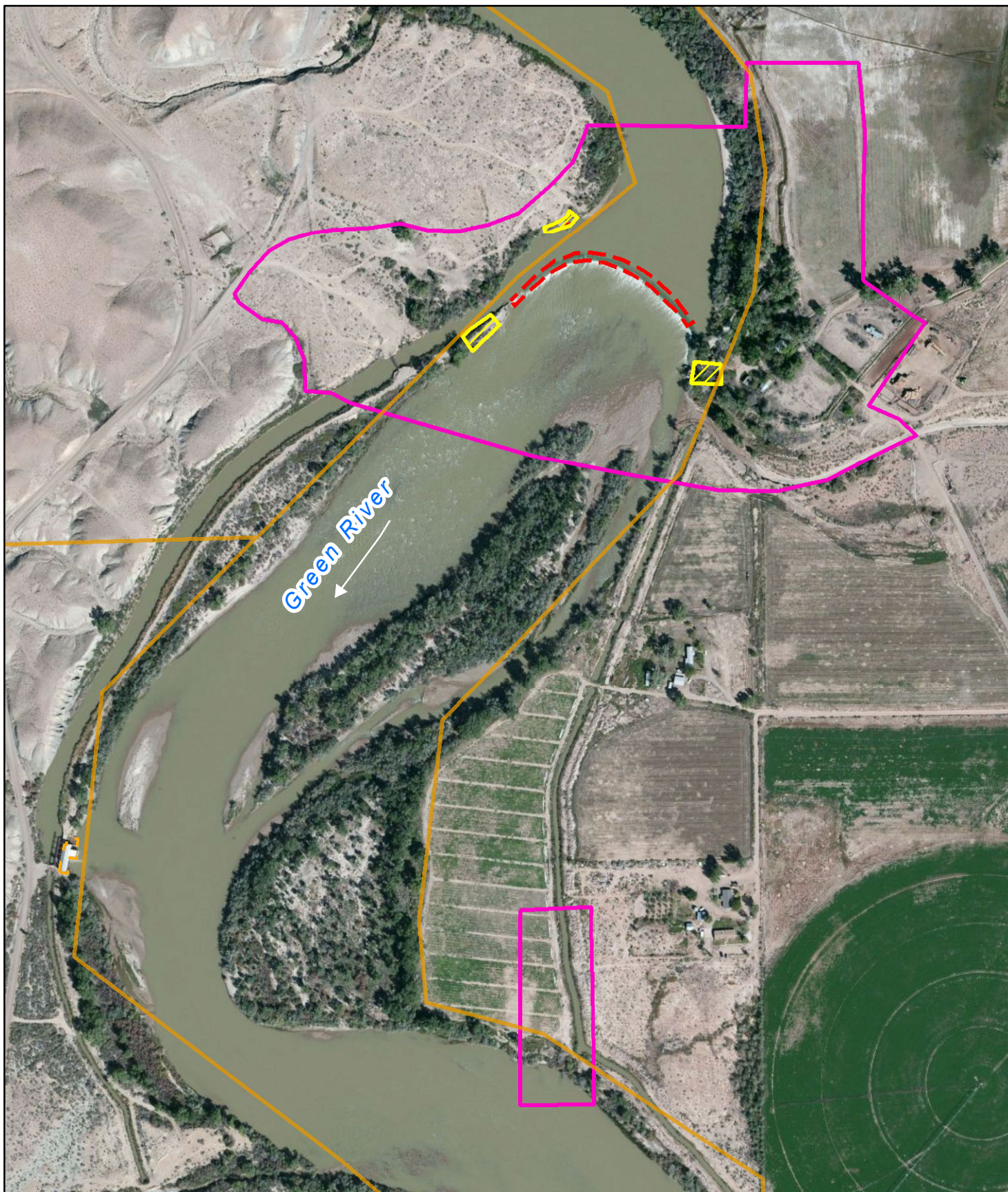


Figure 4-2: Impacts to Plants

NRCS Green River Diversion Rehabilitation
Final EIS

0 250 500 1,000 Feet

McMILLEN, LLC
DESIGN with Vision. BUILD with Integrity.



Legend

- Landowner Boundary
- Thayn Powerhouse
- Clear and Grub (0.5 acres)
- Green River Diversion
- Project Area

NOTES:
Aerial photo from Bing imagery service. Capture date September 2010. Points, lines and polygons supplied by various state and federal sources, including BLM, UDOT, and USGS.

4.6. Animals

Necessary consultation will be performed as required by Section 7 of the ESA and related NRCS guidelines. Section 7(a)(1) of the ESA requires that all federal agencies utilize their authorities in furtherance of the purposes of the Act by carrying out programs for the conservation of endangered species and threatened species. Section 7(a)(2) of the ESA requires that all federal agencies ensure that their actions to authorize, permit, or fund a project do not jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of critical habitat of listed species.

Biological resources include the presence and habitat of fish and wildlife found in the project area. The Migratory Bird Treaty Act of 1918 made it illegal for people to "take" migratory birds, their eggs, feathers, or nests. "Take" is defined in the Act to include by any means or in any manner, any attempt at hunting, pursuing, wounding, killing, possessing, or transporting any migratory bird, nest, egg, or part thereof. In addition, the Bald and Golden Eagle Protection Act affords additional protection against "taking" of bald and golden eagles.

4.6.1. Habitat

4.6.1.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would not impact fish or wildlife habitat. In the event of diversion failure, indirect impacts to habitat would occur, generally associated with erosion and ground disturbance on the east and west banks of the river.

4.6.1.2. Replace In Place Alternative

DIRECT AND INDIRECT IMPACTS

This alternative would result in continued habitat fragmentation. The existing diversion structure has created fragmentation to some degree, and although this alternative would rehabilitate the diversion it would not provide upstream or downstream fish passage. Therefore, connectivity would not be restored to this section of Green River. This alternative would directly impact fish and wildlife habitat, due to the study area designation of critical habitat for two of the four listed endangered fish species found in this reach of the Green River; this issue is provided further detail in Section 4.6.2. Impacts associated with this alternative are the same as presented in Section 4.6.1.3.

4.6.1.3. Preferred Alternative - Replace In Place With Passages

DIRECT AND INDIRECT IMPACTS

The proposed action would directly impact fish and wildlife habitat. However, the proposed action would not result in habitat fragmentation. In fact, the existing diversion structure has created fragmentation to some degree. This alternative provides upstream and downstream fish passage, therefore connectivity

will be restored to this section of Green River. The study area is designated critical habitat for two of the four listed endangered fish species found in this reach of the Green River; this issue is provided further detail in Section 4.6.2. Approximately 1.3 acres of fish habitat (including designated critical habitat for two endangered fish species) would be directly impacted by the downstream armoring of the new diversion structure with riprap proposed by this alternative (Figure 4-3).

This alternative proposes to impact 0.5 acres on the east and west banks of the river. The typical vegetation community within the impacted area consists of willows, cottonwoods and tamarisk along the banks of the river, which could provide habitat for any number of area wildlife. Potential habitat would be permanently cleared to account for the larger gate structures, a new west side gate and structure, and the rehabilitation of the existing gate on the west side. Table 4-5 shows each alternative and the direct impacts to fish and wildlife habitat.

Table 4-5. Summary of Impacts to Fish and Wildlife Habitat*

Resource	Alternatives	Description of Consequences	Specific Resource Impacted Locations and Acreage
FISH AND WILDLIFE HABITAT	No Action	None.	No Effect
	Replace In Place	Loss of vegetation on banks Riprap in channel	Approx. 0.5 acres; 1.3 ac of impact to fish habitat
	Replace In Place With Passages	Loss of vegetation on banks Riprap in channel	Approx. 0.5 acres; 1.3 ac of impact to fish habitat

*Note: the river channel itself is considered designated critical habitat for 2 endangered fish species (see Sec 4.6.2).

CONSTRUCTION IMPACTS AND BMPs

Approximately 7.8 acres of ground on the east and west banks would be temporarily disturbed during construction, mostly for access and staging purposes. Potential impacts to habitat areas would be short-term because project-related disturbance would be during construction only and would not change current conditions. Furthermore, vegetation that is impacted by the project will be replanted with native species.

Approximately 15.9 acres of in-channel work and/or short-term alteration (due to de-watering) would temporarily impact designated critical habitat. This work would only occur during construction and would not permanently alter the channel. The following fish species conservation measures have been committed for implementation by NRCS and UDAF (also presented in the Biological Assessment, Appendix C):

- Construction activities will avoid, to the extent feasible, fish habitat such as backwaters and side channels;
- Best Management Practices (BMPs) will be used to minimize sedimentation, temporary erosion of stream banks, and needless damage or alteration to the streambed. BMPs should also ensure

construction related byproducts do not enter the riverine ecosystem that will cause negative impacts to aquatic organisms;

- Construction activities will be timed to reduce impacts to seasonal fish movements, spawning activity, and rearing activity (April 1 through August 31) depending on the water year;
- Construction activities that occur in the river will be coordinated to minimize impacts to fish:
 - The construction contractor will contact the UDWR to complete a fish survey, clearance and/or salvage immediately prior to and following:
 - Construction of proposed earth cofferdams;
 - Removal of the cofferdams; and
 - Any other occasion when activities occur in the river or in the exposed river channel.
- The contractor will be responsible for reporting any observed take of fish (stressed or dying) immediately to the USFWS office. After placement of the cofferdam, a report will be submitted to the USFWS office that summarizes activities;
- The construction contractor will coordinate with the UDWR to have a federally permitted crew on site to translocate fish stranded behind the constructed cofferdam to the Green River prior to dewatering the work areas;
- Pumps used to dewater the work area will be screened (1/4" mesh) to minimize entrainment of fish;
- The contractor will minimize the time that the cofferdam is in the river;
- As practicable, sections of the cofferdam will be placed gently in the channel to minimize disturbance to fish and the river substrates; and
- All non-permanent materials placed in the river will be removed from the river after completion of the in channel portion of project.

4.6.2. Endangered and Threatened Species and Species of Concern

4.6.2.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would have a direct impact to the four federally endangered fish species known to inhabit or use this reach of the Green River, as well as the other Federal- and state-listed fish species. Currently, there are times of the year when there is no upstream fish passage due to low water flow over the diversion. USFWS recovery efforts call for connectivity in the Green River to ensure support of species survival for spawning migration, drifting of newly produced young-of-year fish, and home-range expansion of juveniles. Terrestrial listed species are not negatively impacted with the No Action Alternative. In the event of diversion failure, indirect impacts to habitat could occur, generally associated with erosion and ground disturbance on the east and west banks of the river.

4.6.2.2. Replace In Place Alternative

DIRECT AND INDIRECT IMPACTS

As noted in Section 4.6.1, this alternative would result in continued habitat fragmentation for listed fish species. The existing diversion structure has created fragmentation to some degree, and although this alternative would rehabilitate the diversion it would not provide upstream or downstream fish passage. Therefore, connectivity would not be restored to this section of Green River. This alternative would

directly impact designated critical habitat for two of the four listed endangered fish species found in the project area; impacts associated with this alternative are the same as presented in 4.6.1.3.

4.6.2.3. Preferred Alternative - Replace In Place With Passages

DIRECT AND INDIRECT IMPACTS

The Preferred Alternative has the potential to directly or indirectly impact listed fish species, by increasing short term suspended sediment in the action area. Table 4-6 below shows the species and critical habitat, listing status, presence or absence of designated critical habitat, and effect determination for species with the potential to occur in the Project and Action Areas.

Table 4-6. USFWS Listed Species and Effects Determinations

Species	USFWS Listing Status*	Critical Habitat County/Project Area	Species Effect Determination	Critical Habitat Effect Determination
Mexican Spotted Owl (<i>Strix occidentalis lucida</i>)	T	Yes/No	May Affect / Not likely to Adversely Affect	No Effect
Southwestern Willow flycatcher (<i>Empidonax traillii extimus</i>)	E	No/No	May Affect / Not likely to Adversely Affect	--
Yellow-Billed Cuckoo (<i>Coccyzus americanus</i>)	T (proposed)	--	Will Not Jeopardize the Continued Existence	--
Bonytail (<i>Gila elegans</i>)	E	Yes/Yes**	May Affect, Likely to Adversely Affect	May Affect, Likely to Adversely Affect
Colorado pikeminnow (<i>Ptychocheilus lucius</i>)	E	Yes/Yes	May Affect, Likely to Adversely Affect	May Affect, Likely to Adversely Affect
Humpback chub (<i>Gila cypha</i>)	E	Yes/Yes**	May Affect, Likely to Adversely Affect	May Affect, Likely to Adversely Affect
Razorback sucker (<i>Xyrauchen texanus</i>)	E	Yes/Yes	May Affect, Likely to Adversely Affect	May Affect, Likely to Adversely Affect

*T=threatened; E=endangered.

**critical habitat exists downstream for these species (see the BA in Appendix C for further detail).

Areas of impact are shown in Table 4-5 and Figure 4-3 provides detail on the location of these impacts. Table 4-6 provides the effects determinations made in the Biological Assessment (Appendix C). In consultation with the USFWS, a Biological Opinion is pending at this time. Project components have been developed to enhance opportunities for species in accordance with USFWS policy and in conjunction with the Upper Colorado River Endangered Fish Recovery Program.

The following threatened, endangered, candidate, or proposed species were identified on both of the County USFWS ESA lists, but were not identified as species that should be considered in an effects analysis, according to the USFWS IPaC Preliminary Species List.

- California Condor (*Gymnogyps californianus*)
- Greater Sage-Grouse (*Centrocercus urophasianus*)

The proposed project would have No Effect to these species or their critical habitat. Additional research has resulted in a conclusion that the California condor may utilize the project area for foraging. The project would have No Effect on this species ability to use the area.

Additionally 12 State/BLM-listed special status species are likely to occur within the project area. Habitat would be permanently and temporarily impacted from this alternative. A biologist would clear access and construction areas prior to disturbance, but this does not eliminate the possibility of encountering species during construction activities. Injury to species may occur if the species are struck by moving equipment during construction activities. These construction-related impacts would be short term in duration and temporary measures would be removed at the end of the project.

CONSTRUCTION IMPACTS AND BMPs

Construction activities have the potential to impact endangered and threatened species that use the area. Indirect impacts to species could occur from vibration. To minimize turbidity and sediment mobilization during dredging and construction, silt curtains would be installed around work areas.

Fish habitat would be temporarily obstructed and degraded due to in-channel work; however, implementation of construction BMPs would minimize this potential. The allowable construction work window for the Proposed Action includes the following:

- Fish (Green River): November 1st through March 31st

The Replace In Place With Passages Alternative involves built-in mitigation opportunities applicable to impacts to all fish species. This alternative includes components that would provide downstream fish passage (stepped fish passage notch incorporates a downstream grade control design for stability and to facilitate fish passage at low flow), upstream fish passage (channel), and PIT tag readers to enhance research, monitoring, and data management opportunities. These components have been developed in accordance with USFWS policy and in conjunction with the Upper Colorado River Endangered Fish Recovery Program. The project may contribute to the continued recovery of endangered species; cumulative effects of the project along with other efforts in the vicinity is covered in Section 4.8.2.

Reestablishment of vegetation would be expected to occur within 2 years of project completion. The following mitigation commitments have been made with regard to the yellow-billed cuckoo and the southwestern willow flycatcher:

- Presence/absence surveys will be conducted by NRCS if construction is scheduled to occur between May 15 and August 31st.
- The contractor will not remove riparian trees unless it is either a non-native tree or specified in the construction drawings.

4.6.3. Invasive Fish Species

4.6.3.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would not change the use of the existing diversion structure; therefore, this alternative would not allow the introduction of additional invasive fish species.

4.6.3.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

All action alternatives include components that provide enhancement features for fish upstream and downstream passage and monitoring. These components have been developed in accordance with USFWS policy and in conjunction with the Upper Colorado River Endangered Fish Recovery Program in an effort to provide opportunities for native fish species to compete in this segment of the Green River. Indirect impacts to invasive fish species would not be anticipated.

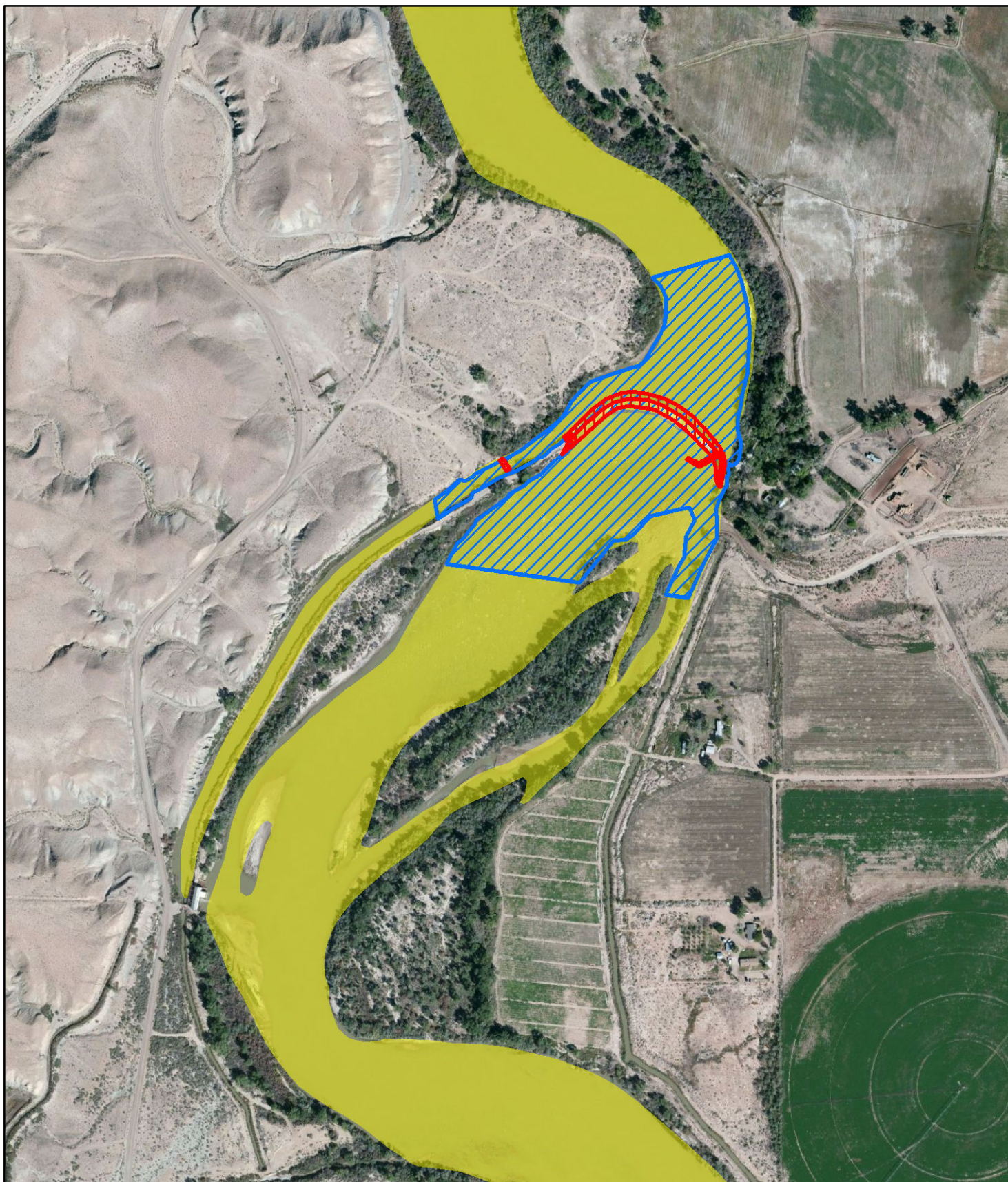





Figure 4-3: Impacts to Endangered & Threatened Fish Species & Critical Habitat
 NRCS Green River Diversion Rehabilitation
 Final EIS

0 300 600 1,200 Feet

McMILLEN, LLC
 DESIGN with Vision. BUILD with Integrity.



Legend

-  Permanent Impacts to Open Water (1.3 Acres)
-  Temporary Impacts to Critical Habitat (15.9 Acres)
-  Colorado Pikeminnow & Razorback Sucker Critical Habitat



NOTES:

Aerial photo from Bing imagery service. Capture date September 2010.
 Points, lines and polygons supplied by various state and federal sources,
 including USFWS, BLM, UDOT, and USGS.

4.6.4. Migratory Birds/Bald and Golden Eagles

4.6.4.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would not impact migratory birds or bald and golden eagles. However, there is a potential for the existing diversion to fail, which could have an indirect impact on trees within the riparian zone. This has the potential to result in an unintentional take of a migratory bird, nest, or egg.

4.6.4.2. Proposed Action – All Alternatives

DIRECT AND INDIRECT IMPACTS

The action alternatives would not have a direct impact on migratory birds or bald and golden eagles. The action alternatives would impact the riparian zone of the project area, which may then result in the unintentional “take” to a potential bird, eagle, nest, or egg. Large cottonwood trees occur within the riparian zone which is primary habitat for these species. Because the riparian zone is the known habitat of migratory birds and bald and golden eagles, the impact to the riparian areas would be the same for all the alternatives, and acreages of impact are shown in Table 4-3.

CONSTRUCTION IMPACTS AND BMPs

It is unlikely that clearing and grubbing activities would impact the nest sites of birds protected by the Migratory Bird Treaty Act. Temporary construction-related effects also include construction noise, increased human activity, and heavy equipment operations, all of which may temporarily disrupt wildlife activities. During construction activities, water quality of the Green River could be impacted due to an accumulation of sediment; however, implementation of construction BMPs would minimize this potential. This could have a temporary impact on the habitat and foraging and nesting capabilities in the short term.

Executive Order 13186, issued on January 11, 2001, affirmed the responsibilities of Federal agencies to comply with the MBTA. To ensure ground-disturbing activities do not result in the “take” of an active nest or migratory bird protected under the MBTA:

- Any groundbreaking activities or vegetation treatments should be performed before migratory birds begin nesting or after all young have fledged to avoid take;
- If activities must be scheduled to start during the migratory bird breeding season, you should take appropriate steps to prevent migratory birds from establishing nests in the potential impact area. These steps could include covering equipment and structures and use of various excluders (e.g., noise). Birds can be harassed to prevent them from nesting on the site.
- If activities must be scheduled during the migratory bird breeding season, a site specific survey for nesting birds should be performed starting at least two weeks prior to vegetation treatments.

Established nests with eggs or young cannot be moved, and the birds cannot be harassed, until all young have fledged and are capable of leaving the nest site;

- If nesting birds are found during the survey, appropriate spatial buffers should be established around nests. Vegetation treatments within the buffer areas should be postponed until the birds have left the nest. Confirmation that all young have fledged should be made by a qualified biologist.

The following migratory bird conservation measures will be committed for implementation by NRCS and UDAF:

- Nesting surveys (presence/absence) will be completed by NRCS if construction is scheduled to occur between May 15 and August 31st.
- The contractor will not remove riparian trees unless it is either a non-native tree or specified in the construction drawings.
- The allowable construction work window for the Proposed Action includes the following:
 - Migratory Birds: September 1st through May 31st

4.7. Human Environment

4.7.1. Socioeconomics

NRCS guidance states that NRCS should administer its programs in a way that considers environmental quality equal to economic, social, and other factors in decision-making (NRCS General Manual, Title 190, Part 410.3[b][III]). This section describes the consequences of each alternative on the social and economic resources within the project vicinity.

As part of the public participation process, the project Public Participation Plan seeks to meaningfully engage minority, low-income, and traditionally under-represented populations during the NEPA process. Documents, notices, and meetings are concise, understandable, and readily accessible to the public; notices of meetings are provided in non-English languages for targeted public audiences, affected landowners, and stakeholders when appropriate; informational material will be made available through a variety of outlets; and, all public events will be scheduled at convenient, accessible locations.

4.7.1.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would have no direct impact on the social and economic resources of the area. The diversion would remain in place and function as it does currently. In the event of a diversion failure, this alternative would have an indirect impact on the properties downstream and resources that depend on water delivery from the diversion. The economic impacts of the loss of this diversion could include the loss of irrigation canals, a hydropower plant, thousands of acres of irrigated cropland, and ultimately an adverse economic impact to the area.

The city of Green River has a 21% Hispanic population that is likely reliant on the agricultural economy. No minority or low-income populations were identified immediately adjacent to the project area that would be adversely or disproportionately impacted; however, in the event of diversion failure, this population would likely be disproportionately high and/or adversely effected by a change in the agricultural economy.

4.7.1.2. *Proposed Action – All Alternatives*

DIRECT AND INDIRECT IMPACTS

The proposed action poses minimal impacts to social resources. Public facilities and services would be minimally impacted during construction. All of the action alternatives propose to impact an equal amount of property. The proposed action would have a beneficial impact on the water supply; the action alternatives both provide a more reliable supply of water for irrigation of crops and hydropower.

The city of Green River has a 21% Hispanic population that is likely reliant on the agricultural economy. No minority or low-income populations were identified immediately adjacent to the project area that would be adversely or disproportionately impacted by the proposed action. Therefore, the proposed action would not have disproportionately high and adverse effects on minority or low-income populations per Executive Order 12898.

4.7.2. Cultural Resources and Historic Properties

4.7.2.1. *No Action Alternative*

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would not directly impact cultural resources, however would have a potential impact on cultural resources. It has been determined that the existing diversion is severely damaged. Without repair or replacement, the existing structure could fail during a flood event, possibly creating direct negative effects on historic properties in the area and downstream.

4.7.2.2. *Proposed Action – All Alternatives*

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

Table 4-6 below summarizes the eligibility determinations made in the Cultural Resources Report and shows project effects and management recommendations for each of the sites found in the project APE.

Table 4-7. Cultural Resources Found in the APE – Summary

Site Type	NRHP Eligibility	Project Effects	Management Recommendations
East Side Canal	Eligible	Adverse effect. Reconstruction or replacement of the Tusher Diversion would impact the point of diversion and structurally alter the canal. Also impacted: fish screen at historic sluice gate.	Mitigate adverse effects through the development of a treatment plan that will become formalized in a Memorandum of Agreement (MOA).
Multi-Component Prehistoric and Historical Site	Eligible Prehistoric Component; Not Eligible Historical Component	None. Site would be avoided by project.	Avoid during construction activities to minimize and mitigate potential impacts
Historical Debris Scatter, Pits, and Road Segment	Not Eligible	None. Site would be avoided by project.	No further recommendations
Historic Inscriptions	Not Eligible	None. Site would be avoided by project.	No further recommendations
Thayn Canal/42-foot Ditch	Eligible	None. Site would be avoided by project.	Avoid during construction activities to minimize and mitigate potential impacts
Green River Canal	Eligible	None. Site would be avoided by project.	Avoid during construction activities to minimize and mitigate potential impacts
Tusher Diversion	Eligible	Adverse effect. Reconstruction or replacement of the Tusher Diversion would permanently impact the diversion to the point that it would no longer be eligible for the NRHP. Also involves east raceway and west raceway impacts.	Mitigate adverse effects through the development of a treatment plan that will become formalized in an MOA.
Hastings Ranch	Eligible	Temporary impacts during construction or rehabilitation. No long term adverse impacts currently anticipated.	Avoid during construction activities to minimize and mitigate potential impacts

NRCS has determined that the Green River Diversion (Tusher) and the East Side Canal are historic properties that would be significantly adversely affected under any of the action alternatives that are analyzed in this EIS. Specifically, adverse effects would result from removal of the existing diversion and replacement of the structure with a modern version.

The adverse effects would be extensive and permanent for any of the action alternatives. For the diversion, the undertaking would result in alteration of the location, design, setting, materials, workmanship, feeling, and association to such an extent that the diversion would no longer be eligible for the NRHP. For the East Side Canal, aspects of integrity such as design, materials, and workmanship that make the site eligible for the NRHP under Criterion C would be adversely affected due to reconstruction of the point of diversion. However, the canal would retain such aspects of integrity as location, setting, feeling, and association that make the property eligible for the NRHP under Criterion A.

Currently, the action alternatives being considered for reconstruction of the diversion would not result in a substantial visual impact to the adjacent historic properties and the overall historical setting. Adverse effects could occur if the design of the replacement diversion dramatically deviated from the appearance of the existing diversion.

CONSTRUCTION IMPACTS AND BMPs

Construction activities, staging of equipment and materials, and river access could result in temporary effects to the remaining sites identified during the cultural resources inventory. Adverse effects to these sites would be averted through implementation of avoidance measures, pre-selection of staging areas, and the use of alternative access routes to minimize effects to historically significant sites.

The Memorandum of Agreement between NRCS, UDAF, Green River Conservation District, BLM, FFSL, John Wesley Powell River History Museum, Mr. Chris Dunham, and the Utah SHPO has been developed. The parties are in agreement with the Treatment Plan, which details the following measures to be implemented:

- Supplemental archaeological site documentation
- Professional-quality article manuscript for the history of the Tusher Diversion Historic District
- National Register of Historic Places Registration for the District
- Archaeological monitoring and report
- Museum-quality permanent display to be installed in the Green River Archives at the John Wesley Powell Museum in Green River, Utah.

4.7.3. Hazardous Materials

4.7.3.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would have no direct impact on hazardous materials or HTRW sites. In the event of a diversion failure, this alternative would have an indirect impact on the properties downstream.

4.7.3.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

No sites have been identified in the immediate project vicinity that would be impacted by the project, directly or indirectly.

CONSTRUCTION IMPACTS AND BMPs

The following BMPs will be implemented:

1. The contractor will identify and minimize the potential for accidental spills of hazardous materials by implementing BMPs and measures specified in the storm water pollution prevention plan (SWPPP). The contractor will develop a spill prevention, control, and countermeasures (SPCC) plan and will follow it during construction.
2. Equipment should be cleaned to remove noxious weeds/seeds and petroleum products prior to moving on site.
3. Fueling machinery should occur off site or in a confined, designated area at a distance of 100 feet or greater from waterways and wetlands to prevent spillage.
4. The contractor will provide watertight tanks or barrels to dispose of chemical pollutants that are produced as by-products of the construction activities, such as drained lubricating or transmission fluids, grease, soaps, concrete mixer wash water, or asphalt. At the completion of the construction work, these containers will be removed and the area restored to its original condition. Sanitary facilities, such as chemical toilets, will be located at a distance sufficient to prevent contamination of any water source. At the completion of construction activities, facilities will be disposed of without causing pollution to the river or soils.
5. Materials should not be stockpiled in the riparian area or other sensitive areas, i.e., wetlands.
6. Fill materials should be free of fines, waste, pollutants, and noxious weeds/seeds.
7. A hazardous materials spill kit will be kept on site during construction that is appropriate for the solvents involved in operation and maintenance of vehicles and machinery used during the Project. Use equipment mats to prevent leakages from entering the river.
8. Concrete, grout, cement mortar, and solid and source site materials will be stored in the staging area.
9. Broadcast applications of herbicides will be prohibited within the Green River's 100-year floodplain; if necessary, spot treatments will be applied by hand using herbicides approved for aquatic habitats by the U.S. Environmental Protection Agency in order to treat noxious weeds within the floodplain.

4.7.4. Recreation

4.7.4.1. No Action

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would have no impact on recreation, public health, and/or safety. Without repair or replacement, the existing structure could fail during a flood event, possibly creating direct negative effects on recreational users and the public.

4.7.4.2. Replace In Place Alternative

DIRECT AND INDIRECT IMPACTS

Direct impacts to recreation would primarily be associated with river recreationists and safe boat passage. This alternative would not provide boat passage; however, the project would provide the same level of passage at high flows as what exists currently; therefore, there would be no impact on the resource.

CONSTRUCTION IMPACTS AND BMPs

During construction, the river itself would be closed to the public due to the safety hazards. Signage would be posted warning boaters and fishermen of the construction activities.

4.7.4.3. Preferred Alternative - Replace In Place With Passages

DIRECT AND INDIRECT IMPACTS

Direct impacts to recreation would primarily be associated with river recreationists and safe boat passage. This alternative includes components to provide relatively safer wet boat passage; therefore, the project has the potential to contribute to the overall enhancement of area recreation, rather than have an adverse impact on the resource.

The project would allow boating on the Green River to extend from Flaming Gorge to Lake Powell or to connect other areas of the river, such as the reach between Swasey's Beach/Boat Ramp and the Green River State Park (Figure 4-4). The inclusion of boat passage would indirectly attract additional recreationists to the project area.

CONSTRUCTION IMPACTS AND BMPs

During construction, the river itself would be closed to the public due to the safety hazards. Signage would be posted warning boaters and fishermen of the construction activities.

4.7.5. Public Health and Safety

Public health and safety hazards known at the diversion could potentially result in serious injury or death. These known hazards include dangerous flow conditions below the structure, scour holes in the river below the diversion, cracked concrete or exposed rebar due to recent damage, swift water in the "pool" above the diversion, limited to no canoe and kayak portages, and other unknown hazards.

4.7.5.1. No Action

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would have a direct impact on public health and/or safety, as it does not provide safe boat passage. Therefore the existing known hazards would remain in place. Without repair or replacement, the existing structure could fail during a flood event, possibly creating direct negative effects on recreational users and the public.

4.7.5.2. Replace In Place Alternative

DIRECT AND INDIRECT IMPACTS

Direct impacts to public health and safety would primarily be associated with river recreationists and safe boat passage. This alternative would not enhance boat passage; therefore the same level of hazard as what exists currently would remain. This alternative includes the installation of deflection log booms and boater warning signs to communicate risks to the public.

CONSTRUCTION IMPACTS AND BMPs

During construction, the river itself would be closed to the public due to the safety hazards. Signage would be posted warning boaters and fishermen of the construction activities.

4.7.5.3. Preferred Alternative - Replace In Place With Passages

DIRECT AND INDIRECT IMPACTS

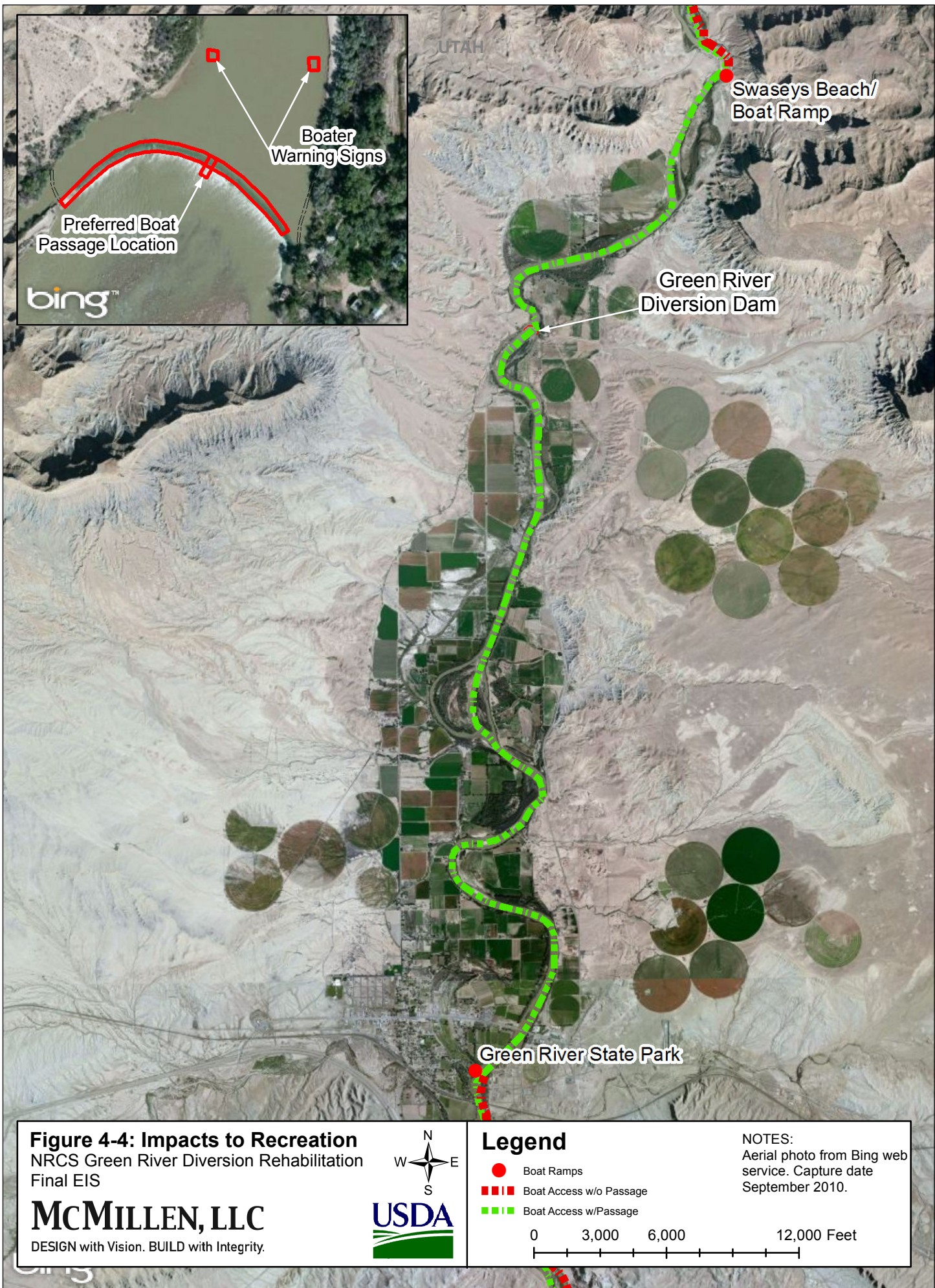
Direct impacts to public health and safety would primarily be associated with river recreationists and safe boat passage. This alternative includes components to provide safe wet boat passage; therefore, the project has the potential to contribute to the overall enhancement of area recreation, rather than have an adverse impact on the resource.

The project would allow boating on the Green River to extend from Flaming Gorge to Lake Powell or to connect other areas of the river, such as the reach between Swasey's Beach/Boat Ramp and the Green River State Park. In addition, boater warning signs would be placed on both banks to ensure that river users were aware of the location of the boat passage over the diversion. This alternative includes the installation of deflection log booms to communicate risks to the public. The inclusion of boat passage would indirectly attract additional recreationists to the project area, which could then translate into further public safety risks associated with high volumes of river recreationists.

The Preferred Alternative would allow for relatively safe boat passage over the crest of the dam at a broad range of flows and would reduce the likelihood of a keeper hydraulic; however, signage will be used in order to direct boaters toward the boat passage chute in the middle of the channel so as to help ensure boater safety. The safe passage of boaters over the diversion structure itself will be addressed further during the final design process. The final design will be independently reviewed by professionals experienced in the design and/or review of structures intended to safely pass boaters over a broad range of flows.

CONSTRUCTION IMPACTS AND BMPs

During construction, the river itself would be closed to the public due to the safety hazards. Signage would be posted warning boaters and fishermen of the construction activities.



4.7.6. Visual Quality, Aesthetics and Scenic Beauty

4.7.6.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative would not change the aesthetic quality of the diversion area. However, in an extreme event such as diversion failure, this alternative has the potential to alter the vegetated areas on banks and properties downstream.

4.7.6.2. Replace In Place Alternative

DIRECT AND INDIRECT IMPACTS

Long-term visual impacts to landscape quality are anticipated to be low. In order to minimize impacts to the scenic beauty of the Green River, the design of the replacement diversion would not deviate from the appearance of the existing diversion. There are no indirect impacts anticipated to visual quality.

4.7.6.3. Preferred Alternative - Replace In Place With Passages

DIRECT AND INDIRECT IMPACTS

This alternative would not change the existing scenic characteristics of the study area or affect the landscape. Long-term visual impacts to landscape quality are anticipated to be low. In order to minimize impacts to the scenic beauty of the Green River, the design of the replacement diversion would not dramatically deviate from the location or appearance of the existing diversion; however, this alternative does include the installation of new, larger radial gates on the east and west ends of the diversion structure.

This alternative would improve the function of the irrigation water delivery system, which in turn supports the existing land use (agricultural production). This alternative also supports a new use of the river (boating) which has no effect on the scenic character of the area.

The new gates along with the boat and fish passage notches do change the look of the structure from various viewpoints in the vicinity. This alternative would change the way the diversion looks from the Hastings Ranch, BLM-managed property on the west side, and from the river upstream; however, the diversion and gate structures, canals, and the waterwheel are all part of the visual character of the site currently.

CONSTRUCTION IMPACTS AND BMPs

Short-term moderate visual impacts would occur at staging and laydown areas and temporary construction easements. The project area would be temporarily disturbed during construction, including in-channel work as well as approximately 8 acres for temporary staging and the use of access roads. All disturbed areas will be reseeded with native vegetation where applicable.

4.7.7. Land Use

4.7.7.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative has the potential to impact existing and future land use in the area if the diversion fails during a flood event. Without repair or replacement, the existing structure could fail during a flood event, possibly creating indirect negative effects on land uses downstream.

4.7.7.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

Land ownership within the project area would not change with the implementation of the proposed action (all alternatives).

Because the State of Utah Division of Forestry, Fire, and State Lands owns the bed of the Green River in the project area, consultation would be ongoing to obtain a Special Use Lease for a permanent 1.3-acre easement for the diversion structure. The repair or replacement of the diversion structure would not directly or indirectly alter land use from existing conditions.

CONSTRUCTION IMPACTS AND BMPs

During construction activities, there may be some temporary impact to area properties and/or infrastructure (utilities). The land uses would not be altered; however, temporary construction easements (with the State of Utah for the use of 15.9 acres of the bed of the river and BLM for the temporary easement on 5.5 acres) to construct could be necessary in order to provide access and staging for construction equipment and resources.

4.7.8. Infrastructure

4.7.8.1. No Action Alternative

DIRECT AND INDIRECT IMPACTS

The No Action Alternative has the potential to impact infrastructure. It has been determined that the existing diversion is severely damaged; therefore, during a flood event the structure could fail, impacting infrastructure such as irrigation pumps and culverts, canals, roads, and utilities downstream.

4.7.8.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and the Preferred Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

The action alternatives would have minimal impact on existing infrastructure because the structure would be placed in the same general location as the existing diversion. These alternatives would not create an overall increase in infrastructure and the proposed action would not impact utilities.

CONSTRUCTION IMPACTS AND BMPs

Existing infrastructure may be temporarily moved or demolished and rebuilt for all alternatives.

4.7.9. Noise**4.7.9.1. No Action Alternative****DIRECT AND INDIRECT IMPACTS**

The No Action Alternative would not impact any sensitive noise receptors in the area.

4.7.9.2. Proposed Action – All Alternatives

The impacts to this resource are the same for both action alternatives (Replace In Place and Replace In Place With Passages).

DIRECT AND INDIRECT IMPACTS

There are no noise-sensitive receptors in the immediate project area; therefore, the proposed action would have no impact on noise-sensitive receptors.

CONSTRUCTION IMPACTS AND BMPs

During construction activities, noise could be generated that would constitute a nuisance to the surrounding residential properties. This would be temporary in nature, and noise mitigation efforts would be utilized.

4.8. Cumulative Effects**4.8.1. No Action Alternative**

No cumulative effects would be anticipated to any of the resources identified from implementation of the No Action Alternative because there would be no change to the existing environment.

Cumulative present and potential foreseeable future effects downstream can add to the effects that have taken place in the past. Sediment deposition from diversion failure would likely fill culverts and drainages in the valley, potentially creating additional flooding issues in the low-lying residential, agricultural, and commercial areas during precipitation events.

4.8.2. Replace In Place Alternative

The implementation of the Green River Diversion – Replace In Place Alternative along with the continued efforts of Trout Limited and the Upper Colorado River Endangered Fish Recovery Program would have a beneficial cumulative effect to the proposed project area in relation to fish passage, due to the project plans to repair the existing upstream passage. The fish barrier proposed downstream of the west raceway would provide a beneficial cumulative effect to ESA listed fish species in the area through an effort to reduce mortality and increase migration through the project area.

There would be no cumulative effects to waters of the U.S. including wetlands, because all wetland impacts associated with the Proposed Action will be mitigated resulting in “no net loss” of wetland functions and values. Cumulative effects are based on the net impacts (i.e., impacts left after mitigation has been applied), not gross impacts. Construction of the other projects included in the cumulative impacts analysis may potentially impact wetlands; however, these impacts would require mitigation in accordance with Section 404 of CWA and Executive Order 11990 requirements.

4.8.3. Preferred Alternative - Replace In Place With Passages

The implementation of the Green River Diversion – Replace In Place With Passages Alternative along with the continued efforts of Trout Limited and the Upper Colorado River Endangered Fish Recovery Program would have a major beneficial cumulative effect to the proposed project area in relation to fish passage upstream and downstream. The fish barrier proposed downstream of the west raceway would provide a beneficial cumulative effect to ESA listed fish species in the area through an effort to reduce mortality and increase migration through the project area.

The Replace In Place With Passages Alternative would have a positive cumulative effect on the navigability of the Green River. The enhancement of navigability in this reach of the river would likely contribute to an increase in the boating and tourism-related economy in the area.

Future projects in the general vicinity of the diversion, such as the Bluecastle Nuclear Power Plant and other large irrigation projects, may eventually apply for water rights on or around the diversion. The potential for future projects requesting adjudicated rights is unknown, and cannot be designed to. The cumulative effect that climate change would have on the project would be likely tied to availability of flows over long periods of time.

There are other river and floodplain alteration activities within the Green River system that could potentially impact ESA listed species and are not part of this project. Private landowners and local towns have initiated armoring their banks to protect against flood events without federal financial assistance. Armoring banks changes the geomorphology of a waterway and may change where the lower portions of the river scour and deposit sediment. The alteration of the geomorphology of the waterway may be determined by how much armoring is installed on the river. However, the amount of armoring being installed by private landowners and small municipalities is so small that the cumulative impacts are

considered insignificant and discountable and may affect ESA listed species but is not likely to adversely affect.

Private landowners may also disturb oxbow wetlands and/or suitable habitat for agriculture practices without acquiring necessary permits or adhering to conservation and minimization measures. These are ongoing activities that have not been evaluated for their effects on ESA listed species but likely have impacts to species and habitat, as well as riparian ecosystems and wetlands. Agricultural practices have also introduced excess nitrogen and phosphorous into the river system from fertilizer and agricultural runoff over the past 100 years. Impacts from the introduction of excess nitrogen and phosphorous into the rivers has not been quantified but may result in changes to the water and soil chemistry within the river and riparian areas resulting in potential impacts to critical and suitable habitat for ESA listed species or the species themselves.

There would be no cumulative effects to waters of the U.S. including wetlands, because all wetland impacts associated with the Proposed Action will be mitigated resulting in “no net loss” of wetland functions and values. Cumulative effects are based on the net impacts (i.e., impacts left after mitigation has been applied), not gross impacts. Construction of the other projects included in the cumulative impacts analysis may potentially impact wetlands; however, these impacts would require mitigation in accordance with Section 404 of CWA and Executive Order 11990 requirements.

4.9. Hazard Potential of Each Alternative

The NRCS General Manual states that an EIS must include a description of the hazard potential of each alternative (Title 190, Part 410.11[e]). In general terms, a *hazard* is defined as any source of potential damage, harm, or adverse health effects on humans or the environment under certain conditions or exposure or vulnerability to injury or loss. In short, a hazard can cause harm or adverse effects. *Risk* is the chance or probability that a person or an environmental resource will be harmed or experience an adverse effect if exposed to a hazard (CCOHS 2010).

This section examines the hazards associated with each alternative and the resulting risks. This section also describes how potential hazards might be mitigated and how hazards might contribute cumulatively to hazardous conditions in the project vicinity.

There are no nearby areas of high landslide potential, and recent reconnaissance of geologic hazards did not reveal any evidence of active faults, landslides, or rockfalls in the study area (Alpha Engineering Company 2010). Seismic hazards are considered relatively low as well; therefore, the most significant hazard at the diversion in terms of structural deficiency is high water flows associated with extreme storm events (100-year event).

The human-related hazards generally associated with the existing diversion are identified in Section 4.7.5, Public Health and Safety.

4.9.1.1. No Action Alternative

The No Action Alternative assumes that the existing diversion would remain in place and irrigation water delivery would continue as is currently. In the 100-year storm event, the following may occur:

- Diversion failure
- Flooding from storm water flows
- Damage to property, structures, roads, and people

4.9.1.2. Replace In Place Alternative

This alternative is in the same general location and proposes a similar structure to divert water from the Green River. This alternative does not pose an increased risk nor does it involve additional hazard associated with the installation of a new structure. In general, this alternative would provide a decreased hazard potential as compared to existing conditions.

4.9.1.3. Preferred Alternative - Replace In Place With Passages

This alternative is in the same general location and proposes a similar structure to divert water from the Green River. This alternative does not pose an increased risk nor does it involve additional hazard associated with the installation of a new structure. In general, this alternative would provide a decreased hazard potential as compared to existing conditions.

4.10. Consistency with Approved Regional Plans for Water Resource Management

Title 190, Part 410.11(E), of the NRCS General Manual requires an EIS to include “information identifying any approved regional plans for water resource management in the study area and a statement on whether the proposed project is consistent with such plans.”

The entire study area for the Green River Diversion Rehabilitation project is located in the Green River Basin, which is part of the larger Western Colorado River Basin. The project is consistent with the regional plans for water-resource and irrigation water management in the area, which are listed below along with the basic goals or policies of each plan.

From the Utah State Water Plan (UDEQ, May 2001):

- West Colorado River Basin Plan (August 2000) - describes the current state of the basin and explores potential water-management approaches. The document does not include goals or recommended specific actions but does include a discussion about potential ways to manage the basin’s water supply. Specific areas of focus include water supply, water conservation, water transfers, and efficient management of developed supplies, water development, and water quality in the Green River Basin.

- **Conjunctive Management of Surface and Ground Water in Utah (July 2005)** - describes the problems facing Utah's ground water resources and shows how conjunctive management offers proven methods to mitigate some of these problems and thus more fully utilize the available water supply. The document encourages professionals in the water supply industry to investigate and implement these concepts, and assists with the navigation of some of the legal and institutional requirements for actual projects. The intent of the plan is to encourage community and government leaders to facilitate projects through such actions as setting aside lands that are uniquely situated to allow underground water storage.

Utah Code:

- **Utah Administrative Code R317-2 Utah Nonpoint Source Pollution Management Plan (October 2000)** includes objectives in environmental protection such as (1) to conserve waters of the state; (2) to protect, maintain, and improve the quality of waters of the state for public water supplies, species protection and propagation, and for other designated beneficial uses; and (3) to provide for the prevention, abatement, and control of new or existing sources of polluted runoff. This plan specifies goals for irrigation water management, emphasizing the importance of wise and efficient use of water. Irrigation efficiency BMPs for the application and rate of use, as well as the reduction of salinity are also discussed.

4.11. Relationship between Short-Term Uses and Long-Term Productivity

The proposed action would unavoidably affect the natural resources, agricultural economy, and recreational use of the project area. Some of the effects and impacts would be positive and some would be negative. The improvements in irrigation delivery that would result from the proposed action are based on the state of Utah and NRCS comprehensive planning. The short-term impacts and the commitment of resources are consistent with the maintenance and enhancement of long-term productivity for the state and local area.

4.12. Irreversible and Irretrievable Resource Commitments

NEPA requires that environmental analysis include identification of "... any irreversible and irretrievable commitments of resource which would be involved in the Proposed Action should it be implemented." Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects this use could have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural resource).

4.12.1. No Action Alternative

The No Action Alternative would involve no changes to the project area; therefore, there would be no commitment of additional resources associated with the proposed action. However, physical and financial resources would still be required to maintain the current infrastructure. Over time, these resources could resemble the commitments for the action alternatives because some of the infrastructure would eventually need to be completely replaced.

4.12.2. Proposed Action – All Alternatives

Implementing the proposed action would involve a commitment of a range of natural, physical, human, and fiscal resources. Considerable amounts of fossil fuels, labor, and construction materials (such as cement and aggregate) would be expended. Additionally, large amounts of labor and natural resources would be used in the fabrication and preparation of construction materials. These materials are generally not retrievable. They are not, however, in short supply and their use would not have an adverse effect upon continued availability of these resources. Any construction would also require a substantial one-time expenditure of federal and cost-share funds that would not be retrievable.

The commitment of these resources would be based on the premise that residents in the immediate area, the state, and the region would benefit by the improved quality of the diversion, the enhancement of fish passage, and opportunities for monitoring; the provision for navigability and boat passage, thereby indirectly improving recreation opportunities; and irrigation system improvement. These benefits generally are anticipated to outweigh the permanent commitment of resources.

4.13. Unresolved Issues

4.13.1. Flow Allocation Agreement

It is anticipated that an agreement regarding water flow allocations would be developed between all parties with interest in the function of the diversion in conjunction with the O&M Plan. This agreement has not been developed for the FEIS; however, this agreement may be in draft form in order for the NRCS to make a final decision on the project.

4.13.2. Operation and Maintenance (O & M) Plan

A specific O&M Plan will be prepared by the NRCS, UDAF, local stakeholders, the Recovery Program, and the State of Utah that will govern the use of the structures (see Section 3.6.2). The specific details of the O&M Plan and agreement will be determined during final design and be entered into by all applicable parties prior to the start of construction activities.

4.13.3. Biological Opinion

The NRCS has finalized the Biological Assessment, prepared in compliance with Section 7 of the ESA (16 U.S.C. 1536 (c)) to address potential project-related impacts on USFWS-listed fish, wildlife, and plant species designated as threatened, endangered, proposed, or candidate species and their associated critical habitat. The Biological Assessment has determined that the action May Affect, and is Likely to

Adversely Affect four fish species and two areas designated as critical habitat. The USFWS must prepare, through formal consultation, a biological opinion on whether the proposed activity will jeopardize the continued existence of the species. This opinion is forthcoming and the results will be presented in the ROD.

4.13.4. Cultural Resources Memorandum of Agreement and Treatment Plan

NRCS will resolve the adverse effects to the diversion and the East Side Canal through the development of a Treatment Plan. This Treatment Plan has been developed through NRCS consultation with the Utah SHPO and other interested agencies and tribes. Once the Treatment Plan is agreed upon by the consulting parties, a Memorandum of Agreement (MOA) will be executed and implemented pursuant to compliance with Section 106 of the National Historic Preservation Act. The MOA is currently in the process of being signed by all consulting parties. This process will be documented in the ROD, when NRCS may recommend that the Preferred Alternative be allowed to proceed to Final Design.

CHAPTER 5. CONSULTATION, COORDINATION, AND PUBLIC PARTICIPATION

5.1. Introduction

This chapter describes the public and agency coordination efforts for the Green River Diversion Rehabilitation Project. The intent of the proposed action is to implement a solution that would stabilize the existing diversion structure while ensuring water delivery to water right holders, provide fish passage upstream and downstream, and address recreational concerns.

5.2. Agency Consultation

The agencies listed in Chapter 7, Distribution were invited to comment on the project during the scoping period. Additional consultation will be performed with all interested agencies during the FEIS review period and the results of this consultation will be documented in the Final EIS and ROD.

The Proposed Action would require work within BLM property. NRCS has coordinated with the BLM (a cooperating agency) regarding the project. A temporary use permit will be required for the staging and access for the construction activities associated with the project. Consultation with the BLM will be ongoing, and once the project design has advanced further coordination will be necessary for modification of the rights-of-way and/or easements. The preliminary assessment of impacts to BLM lands and listed plant species described in this document have identified that there will be impacts from each of the Action alternatives. Further coordination with the BLM will be performed as the project progresses during final design.

The Proposed Action would require work on the bed of the Green River, within the project area, which is considered sovereign land owned by the State of Utah and managed by the Utah Division of Forestry, Fire and State Lands (a participating agency). A Special Use Lease will be required for the construction activities and the structure. Further consultation and coordination with FFSL will continue as the project progresses to ensure navigability through the Diversion.

NRCS has coordinated with Utah SHPO regarding the project under formal consultation (Utah State Antiquities Project Number: U-13-SH-0354bps). The report prepared for the project describing the results of the literature review and pedestrian survey concluded that there are cultural and historical resources within the project area. The report was submitted to Utah SHPO for a concurrence of an Adverse Effect to 2 NRHP-eligible sites, the Green River Diversion and the East Side Canal. The concurrence letter from Utah SHPO is located in Appendix D. The results of the consultation with SHPO on this project will be documented in the Final EIS.

Informal consultation with the USFWS (a participating agency) has concluded in the determination that the project will impact Threatened and Endangered species. The Biological Assessment describes the results of the literature review and pedestrian survey. A request for formal consultation with the agency

has been submitted to provide adequate project information and mitigation commitments to develop the Biological Opinion. The results of the consultation with USFWS on this project will be documented as part of the Record of Decision.

The Proposed Action would require work within jurisdictional waters of the U.S. A USACE Section 404 permit will be required to complete the construction activities associated with the project. Consultation with the USACE will be performed once the project design has advanced to identify dredge/fill impacts (area and volume) to jurisdictional waters. The preliminary assessment of impacts to jurisdictional waters of the U.S. described in this document has identified that there will be impacts associated with the Proposed Action. Further coordination with the USACE will be performed as the project progresses during final design.

5.3. Coordination

UDAF requested financial assistance from the NRCS to mitigate flood damage incurred in 2011 through Standard Form 424 – Application for Federal Assistance in 2011. Initial coordination was conducted between the NRCS and UDAF regarding the project through the preparation of a DSR. The DSR documented the eligibility of the damaged structures for inclusion in the EWPP. NRCS, through the preparation of the DSR, concluded that the project was eligible for funding under EWPP but would require additional analysis under NEPA. Meetings were conducted with the NRCS, UDAF, and local stakeholders to discuss the project and identify potential concerns relating to the project. The results of these meetings and discussions have been incorporated into this document.

5.4. Project Chronology

Table 5-1 lists the project's public outreach activities. The public was notified of each activity listed below and provided with opportunities to comment on the project.

Table 5-1. Public Outreach Activities

Date	Purpose	Type
October 30, 2012	Scoping Period Open	Comment Period Open
October 30, 2012	Scoping Meeting Notice	Scoping Notice Mailed
November 5, 2012	Scoping Meeting Notice	Posters displayed in community gathering places
November 6, 2012	Scoping Meeting Notice	Local Newspapers
November 8, 2012	Scoping Meeting Notice	Local Newspapers
November 13, 2012	Scoping Meeting Notice	Local Newspapers
November 15, 2012	Scoping Meeting Notice	Local Newspapers
November 15, 2012	Scoping Meeting	Public Meeting in Green River
November 30, 2012	Scoping Period Close	Comment Period Close

Date	Purpose	Type
May 29, 2013	2 nd Scoping Period Open	Comment Period Open
May 29, 2013	Scoping Meeting Notice	Scoping Notice Mailed
May 29, 2013	Scoping Meeting Notice	Local Newspapers
May 30, 2013	Scoping Meeting Notice	Local Newspapers
June 3, 2013	Scoping Meeting Notice	Federal Register
June 4, 2013	Scoping Meeting Notice	Local Newspapers
June 5, 2013	Scoping Meeting Notice	Local Newspapers
June 6, 2013	Scoping Meeting Notice	Local Newspapers
June 12, 2013	2 nd Scoping Meeting	2 Telebriefings
July 2, 2013	2 nd Scoping Period Close	Comment Period Close
March 14, 2014	DEIS Public Comment Period Open	Comment Period Open
March 14, 2014	Notice of Availability, Mailings, Public Notice	Mailed, published in local newspapers, posted at library, City Hall, published in Federal Register
April 10, 2014	Public Meeting	Public Meeting in Green River
April 30, 2014	DEIS Public Comment Period Close	Comment Period Close
June 16 – 20, 2014	Notice of Availability, Mailings, Public Notice	Mailed, published in local newspapers, posted at library, published in Federal Register
June 20, 2014	Final EIS Review Period	Review Period Open
July 19, 2014	Final EIS Review Period Close	Review Period Close
TBD	Record of Decision	Published in Federal Register

5.5. Public Participation Plan

The *Public Participation Plan* dated October 2012 was prepared to provide effective procedures that define outreach to the general public, recreationists, local businesses, associations, stakeholders, affected landowners, and affected government agencies. The main goal of public participation is to involve a diverse group of public and government agency participants to solicit input and provide timely information throughout the NEPA review process. In order to best accomplish this, the following objectives were utilized:

- Establish ongoing, inclusive, and meaningful two-way communication with stakeholders, affected landowners, agencies, and the general public.
- Educate the public about the environmental review process and each party's role.

- Evaluate the effectiveness of public participation activities on a continual basis in order to refine the public participation plan, as necessary, and utilize the most effective techniques throughout the NEPA process.
- Document all public and government agency input.

As part of the public participation process, the plan will seek to meaningfully engage minority, low-income, and traditionally under-represented populations during the NEPA review process. As a general rule, the following principles will be adopted to support involvement of “environmental justice” populations:

- Documents, notices and meetings will be made concise, understandable, and readily accessible to the public.
- Notices of meetings will also be provided in non-English languages for targeted public audiences, affected landowners, and stakeholders when appropriate.
- Informational material will be made available through a variety of outlets.
- All public events will be scheduled at convenient, accessible locations.

5.6. Project Scoping

Project scoping questions, comments, and concerns were requested from the public and government agencies during the preliminary scoping period, both orally at public meetings and via written submittal of comments. The main goal of public participation during the scoping period was to involve a diverse group of public and government agency participants to solicit input and provide timely information regarding their concerns pertaining to the project and the proposed alternatives.

The original scoping period officially opened on October 30, 2012 and ended on November 30, 2012 for a total of 31 days. The 2nd scoping period opened on May 29, 2013 and ended on July 2, 2013 for a total of 35 days. Official comments received during the original and 2nd scoping periods are included in Appendix A.

5.6.1. Original Project Scoping Meeting

A scoping notice was prepared and sent to interested parties and regulatory agencies on October 30, 2012. The distribution list, as presented in Section 7.0, was prepared by both the NRCS and UDAF. The scoping notice gave a description of the project, location and overview, purpose and need, identified preliminary scoping issues, and requested public participation. The scoping notice also identified the location of public meetings, contact information to submit written comments, and the scoping period closure date. One public scoping meeting was conducted on November 15, 2012. Written comments could have been submitted via mail, e-mail, facsimile, or comment card, and oral comments could have been submitted over the phone or in person. There were 11 oral or written comment documents received for the Green River Diversion Project during the scoping period.

5.6.2. Second Public Scoping Meeting

Initially, it was determined that the Green River Diversion Rehabilitation Project would follow NEPA guidelines through the EA process. Comments made during the first public scoping period as well as numerous agency meetings supported the EA process. However, during consultation with the SHPO, it was determined that the diversion could be of historic importance and possibly be eligible for listing on the NRHP. Consequently, any modification to the diversion might result in an adverse effect to the historic resource. The consequences of several alternatives (discussed in Section 4) could result in impacts to the diversion considered “significant” to cultural resources. Due to the potential for a significant resource impact, NRCS decided to prepare an EIS for the project instead of an EA. The NOI to prepare an EIS was published and a second scoping period was opened during the period of May 29, 2013 to July 2, 2013.

The second public scoping meeting consisted of two Telebriefings on June 12, 2013. One was held at 2:00 PM to accommodate agency personnel and their schedules, and one at 6:00 PM to accommodate the general public and stakeholders. Written comments could have been submitted via mail, e-mail, facsimile, or comment card, and oral comments could have been submitted via phone or in person. There were 39 oral or written comment documents received for the Green River Diversion Project during the 2nd scoping period.

5.6.3. Project Scoping Comments

All comments including those from the general public, government, landowners, and stakeholders were sent to McMillen, LLC’s office in Boise, Idaho for tracking and were scanned and delivered to the NRCS during the comment period. Comments were incorporated into a matrix according to topic and each one individually addressed as presented in Appendix A. Comments were sorted into the following categories:

- Agriculture
- Boat Passage
- Construction Alternatives
- Construction Impacts
- Dam Decommission
- Dam Rehabilitation
- Electrical Barrier
- Fish Passage
- Floods
- Funding/Economics
- Habitat
- Historic Preservation
- Hydropower Plant
- Irrigation
- NEPA Process
- Permits
- Sediment
- Water Wheel

5.7. Draft EIS

A public notice describing the proposed project and providing notice of availability of the DEIS was mailed to interested parties (Chapter 7, Distribution) on March 14, 2014, published in local newspapers (The Sun Advocate, Moab Times-Independent, Salt Lake Tribune, Emery County Progress, Deseret News, and ETV News) on March 14 and April 3, 2014, and posted to the NRCS project website. The

DEIS was released for public review and comment via the website and hard copies of the DEIS were sent to the NRCS Price Field Office, the Grand County Public Library, Green River City Hall, and the John Wesley Powell River History Museum for viewing between March 14 and April 30, 2014. One combined agency and public DEIS meeting was conducted on April 10, 2014 at the John Wesley Powell River History Museum. There were 39 in attendance at the meeting.

The DEIS comment period was open between March 14 and April 30, 2014. Written comments could have been submitted via mail, e-mail, facsimile, or comment card, and oral comments could have been submitted via phone or in person. Table 5-2 categorizes the 83 oral or written comments received from both public and agencies for the Green River Diversion DEIS during the DEIS comment period.

Table 5-2. DEIS Comments

Comment Category	Comment (General, Summarized)
Recreation/Boat Passage & Navigability	We support the "Replace in Place with Passages" alternative and the chute in the center of the dam.
Economy & Tourism	Project would enhance tourism/economy in the area.
Public Health and Safety	Existing diversion is a danger/threat to public safety.
Impacts to T & E Species; Fish	Support fish passage; DEIS does not adequately address this issue; Biological Assessment should be included. Fish passages would help the threatened and endangered native fishes have expanded access to habitat.
Nuclear Power Plant	Generally, the addition of a nuclear power plant in the vicinity of the project could impact water availability and should be further addressed in the EIS.
Climate Change/Foreseeable Streamflow Changes	DEIS does not adequately address this issue (loss of streamflow due to climate change)
Budget	The planned funding for this project is primarily from federal and state governments. As the damage claimed is related to the high water of 2011 it would seem reasonable that the Appendix include a log of maintenance for the past several decades. I would be very interested in seeing this information.
Hydroelectric Power	Include hydropower plant in design
Irrigation/Flood Control	Support project to maintain the benefits of irrigation and flood control; boat passage a benefit without affecting the ability to withdraw irrigation water from the Green River.
Impacts to Aquatic Resources	Project has the potential to adversely impact aquatic resources, including wetlands, streams, riparian areas, their supporting hydrology and hydrogeology.

5.8. Final EIS

A public notice providing notice of availability of the FEIS will be distributed to interested parties (Chapter 7, Distribution) on June 20, 2014, published in local newspapers (The Sun Advocate, Moab Times-Independent, Salt Lake Tribune, Emery County Progress, Deseret News, and ETV News) on June 17, 2014, and posted to the NRCS project website. The FEIS was released for public review via the website and hard copies of the FEIS were available for review at the NRCS Price Field Office, the Grand County Public Library, Green River City Hall, and the John Wesley Powell River History Museum between June 20 and July 19, 2014.

The FEIS has taken into consideration all scoping and DEIS comments received. The input of the public and agencies, wherever applicable, has been incorporated into the project.

5.9. Record of Decision

NRCS will consider comments on this FEIS as it completes a Record Of Decision (ROD) for the project. NRCS will not respond to comments on the FEIS. The ROD will identify the selected alternative, specify reasons why NRCS chose the selected alternative, disclose what NRCS expects will be the project-related impacts of the selected alternative, and list any mitigation commitments associated with the selected alternative. The earliest date when NRCS can file the ROD is 30 days after the release of the FEIS.

If the selected alternative would require other Federal actions such as Federal permits or authorizations, then the permitting or authorizing agencies can use the FEIS to compile their decision documents as appropriate.

CHAPTER 6. LIST OF PREPARERS

6.1. EIS Preparers

Table 6-1 lists the people who participated in the preparation of this EIS.

Table 6-1. List of Preparers

Name	Title (Years Experience)	Education	Other
NRCS – Utah			
Norm Evenstad	Water Resources Coordinator (25)	B.S. – Geology	Utah PG
Bronson Smart	State Engineer (14)	B.S. – Civil and Environmental Engineering M.S. – Civil Engineering	Utah PE
Anthony Beals	EWP Specialist	B.S. – Agronomy	
McMillen, LLC			
Greg Allington	Project Manager/Biologist (9)	B.S – Wildlife Ecology	
Dan Axness	Engineer (21)	B.S. – Agricultural Engineering M.S. – Bioresource Engineering	
Kevin Jensen	Engineer in Training (4)	B.S – Civil Engineering	
Aimee Hill	NEPA Specialist (15)	B.S. – Environmental Health	
Browne Consulting, LLC			
Peggy Browne	Ecologist (16)	B.S. – Rangeland Ecology	
Tetra Tech			
Merri Martz	Project Manager/Biologist		

CHAPTER 7. DISTRIBUTION

A notice of availability for the DEIS was distributed to the following government agencies/staff and organizations.

7.1. Federal Government

Bureau of Land Management
Bureau of Reclamation
National Park Service
Natural Resource Conservation Service
Office of Environmental Policy and Compliance
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish & Wildlife Service

7.2. Tribal Government

Ute Indian Tribe of the Uintah & Ouray Reservation, Utah

7.3. State Government

Bureau of Environmental Health Services
Green River State Park
State of Utah - Office of the Governor
Utah Association of Conservation Districts
Utah Department of Agriculture
Utah Department of Community and Culture
Utah Department of Environmental Quality
Utah Department of Heritage and Arts
Utah Department of Natural Resources
Utah Department of Public Safety
Utah Division of Drinking Water
Utah Division of Forestry, Fire & State Lands
Utah Division of Water Rights
Utah Division of Wildlife Resources
Utah Ecological Services Field Office
Utah Environmental Congress
Utah Fish and Wildlife Conservation Office
Utah National Parks Council
Utah Natural Heritage Program
Utah Public Land & Policy Coordination Office
Utah Reclamation Mitigation & Conservation Commission
Utah Rivers Council
Utah School and Institutional Trust Lands Administration (SITLA)

7.4. Local Government

Emery County Ambulance

Emery County Commissioners
Emery County Sheriff, County Seat
Emery County Sheriff, Local Office
Grand County Sheriff
Grand County Council
Grand County Utah Emergency Medical Services
Green River City Fire Department
Green River City – Mayors Office
Green River Medical Center

7.5. Organizations

Historic Preservation Commission
Living Rivers
Public Lands Equal Access Alliance
Utah Wildlife Federation
Western Land Exchange Project
Wild Utah Project

7.6. Businesses

Adrift Adventures
Adventure Bound
American River Touring Assoc.
American Whitewater
Bill Dvorak Kayak and Rafting
Breckenridge Outdoor Education
Canyon River Company
Canyon Voyages Adventures Company
Carbon County Recreation
Centennial Canoe Outfitters
Colorado Rivers & Trail Expeditions
Desolation Canyon Outfitters
East Side Canal Company
Friendship Cruise
Green River Canal Company
Holiday River Expeditions
Jacks' Plastic Welding Inc
Moab Rafting and Canoe Company
Moki Mac River Expeditions
Moki Treks, Inc.
National Outdoor Leadership School
Nichols Expeditions, Inc.
Oneway Boatworks
Pacificorp
Prescott College
Provo Canyon School
River Runners for Wilderness
Sheri Griffith River Expeditions
SPLORE

Tag-a-long Tours
Thayn Power Plant
The Women's Wilderness Institute
Weber State University
Western River Expeditions
World Wide River Expeditions

7.7. Private Parties

The names and addresses of private parties who received notices of the DEIS and FEIS are not listed in this section for privacy.

CHAPTER 8. REFERENCES

- AGFD (Arizona Game and Fish Department). 2001. Arizona Game and Fish Department Heritage Data Management System. Gila elegans. Unpublished abstract compiled and edited by the Heritage Data Management System, Phoenix Arizona.
- Alpha Engineering Company. 2010. Green River Diversion Dam. Preliminary Design Report. Prepared for the Green River Diversion Dam Cooperative. Alpha Engineering Company, St. George, Utah. In coordination with RB & G Engineering, Inc., Provo, Utah.
- Amtrak. 2012. Amtrak Fact Sheet, Fiscal Year 2012, State of Utah. Available at amtrak.com/pdf/factsheets/UTAH12.pdf.
- Bates, J. W., and M. O. Moretti. 1994. Golden Eagle (*Aquila chrysaetos*) population ecology in eastern Utah. *Great Basin Nat.* 54:248-255.
- Belliston, N., R. Whitesides, S. Dewey, J. Merritt, S. Burningham. 2009. *Noxious Weed Field Guide for Utah*. 3rd Edition.
- BLM 2011. BLM Sensitive Plant Species List for Utah, February 2011.
- BLM. 2014. Desolation Gray Canyons River Permit System. Available at <http://www.blm.gov/ut/st/en/fo/price/recreation/riverinf.html>.
- Campos, Brent R. 2005. The evolution, demise, and restoration of the native fishes of the lower Colorado River.
- Canadian Centre for Occupational Health and Safety. 2009. Definitions – Hazard and Risk. Available at http://www.ccohs.ca/oshanswers/hsprograms/hazard_risk.html.
- Cavalli, Peter A. 2000. *An Evaluation of the Effects of Tusher Wash Diversion Dam on Movement and Survival of Juvenile and Subadult Native Fish*. Publication Number 01-1, Utah Division of Wildlife Resources.
- Cayan, D., M. Tyree, K.E. Kunkel, C. Castro, A. Gershunov, J. Barsugli, A.J. Ray, J. Overpeck, M. Anderson, J. Russell, B. Rajagopalan, I. Rangwala, and P. Duffy. 2013. Future Climate: Projected Average. In *Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment*; G. Garfin, A. Jardine, R. Merideth, M. Black, and S. LeRoy (eds.), 101–125. A report by the Southwest Climate Alliance. Washington DC: Island Press.
- CBD (Center for Biological Diversity). 2007. Bald Eagle Population Exceeds 11,000 Pairs in 2007. Long-term trend for each state available for first time. Available at biologicaldiversity.org.

- City of Green River. 2012. Zoning Ordinance of the City of Green River Utah. Available at sterlingcodifiers.com/codebook/index.php?book_id=432.
- City of Green River. 2013. City website; Crossroads of the West. Public Resources section. Available at greenriverutah.com/public-resources.
- Clark, Carl. 2012. Personal Communication between Ana Vargo (NRCS) and Carl Clark. Regarding the presence of the seep area downstream of the right abutment on Green River Diversion. August 22, 2012.
- EDR (Environmental Data Resources, Inc.). 2013. The EDR Radius Map™ Report with GeoCheck®. 440 Wheelers Farms Road, Milford, CT.
- Emery County. 2008. Emery County General Plan, County Policies, Objectives, and Action Steps. Adopted Autumn 1996. Revised October 1999. Available at emerycounty.com/publiclands/ECGenPlan/GenPlan10-99.pdf.
- Emery County Weed and Mosquito Department. 2013. General Notice to Control Noxious Weeds. Published in Emery County Progress. April 2, 2013. Available at ecprogress.com.
- EPA (U.S. Environmental Protection Agency). 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Prepared by the EPA Office of Noise Abatement and Control. Available at nonoise.org/library/levels74/levels74.htm.
- EPA. 2009. AQI Air Quality Index; A Guide to Air Quality and Your Health. Office of Air Quality Planning and Standards, Outreach and Information Division, Research Triangle Park, NC. EPA-456/F-09-002.
- EPA. 2012. Water Quality Assessment. Watersheds. Utah. www.epa.gov/waters/index. Accessed June 19, 2012.
- EPA. 2013. Climate Change; Greenhouse Gas Emissions. Available online at epa.gov/climatechange/ghgemissions/.
- FAA (Federal Aviation Administration). 2013. Green River Muni. U34. Available online at <https://nfdc.faa.gov>.
- FEMA (Federal Emergency Management Agency). 2013. Floodplain map service center. Available at <https://msc.fema.gov/>.
- Find The Data. 2013. Compare City Economic Facts (American Community Survey). Compiled from the 2010 U.S. Census Bureau Data. Available online at: <http://acs-economic-city.findthedata.org/l/26327/Green-River-Utah>.

- Fox, D.L., and T. Murphy. *Lynx canadensis* Canada Lynx. Animal Diversity Web. University of Michigan Museum of Zoology. Available at animaldiversity.ummz.umich.edu/accounts/Lynx_canadensis.
- Gerner, S.J., L.E. Spangler, B.A. Kimball, D.D. Wilberg, and D.L. Naftz. 2006. Hydrology and Water Quality in the Green River and Surrounding Agricultural Areas near Green River in Emery and Grand Counties, Utah, 2004-05. U.S. Geological Survey Scientific Investigations Report 2006-5186.
- Governor's Council on Balanced Resources. 2013. The State of Utah Outdoor Recreation Vision. Prepared in coordination with the Outdoor Recreation Advisory Group. Available online at utah.gov/governor/docs/OutdoorRecreationVision.pdf.
- Grand County. 2008. Land Use Code (LUC). Title 16, Grand County Ordinances. Prepared by Four Corners Planning, Inc. Available at grandcountyutah.net/pdf/planning/LUC041708.pdf.
- Groves, David G., Fischbach, Jordan R., Bloom, Evan, Knopman, Debra, and Keefe, Ryan, 2013. "Adapting to a Changing Colorado River: Making Future Water Deliveries More Reliable Through Robust Management Strategies". Published by the RAND Corporation and prepared for U.S. Bureau of Reclamation.
- Gunnison Sage-grouse Rangewide Steering Committee. 2005. *Gunnison sage-grouse rangewide conservation plan*. Colorado Division of Wildlife, Denver, Colorado.
- Hintze, L.F., G.C. Willis, D.Y.M. Laes, D.A. Sprinkel, and K.D. Brown. 2000. Digital Geologic Map of Utah. Utah Geological Survey. Available online at <http://geology.utah.gov/maps/geomap/statemap/index.htm>.
- Hultine, K.r., S.E. Bush, and J.R. Ehleringer. 2010. Ecophysiology of riparian cottonwood and willow before, during, and after two years of soil water removal. *Ecological Applications* 20:347-361.
- Kenney, T.A., Wilkowske, C.D., and Wright, S.J., 2007. *Methods for Estimating Magnitude and Frequency of Peak Flows for Natural Streams in Utah*. U.S. Geological Survey Scientific Investigations Report 2007-5158.
- Kochert, M. N., K. Steenhof, C. L. McIntyre, and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*). In *The Birds of North America*, No. 684 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Land Use History of North America (LUHNA). 2013. Colorado Plateau. Biota of the Colorado Plateau. Threatened and Endangered Species. Available at cpluhna.nau.edu/biota/endangered_species.htm.
- NRCS (Natural Resources Conservation Service). 2003. National Operation and Maintenance Manual for Conservation Practices Installed with NRCS Assistance. 180-V-NOMM, Second Edition. May 2003.
- NRCS. 2004. Emergency Watershed Protection Program Final Programmatic Environmental Impact Statement. December 2004.

- NRCS. 2008. Biological Assessment for Green River Salinity Area Colorado River Water Quality Improvement Program and the Colorado River Salinity Control Program.
- NRCS. 2010a. National Emergency Watershed Protection Program Manual, Title 390 – Project Development and Maintenance Parts 510-515. M_390_Amend 3, November 2010.
- NRCS. 2010b. NRCS General Manual, Title 190 – Ecological Sciences, Part 410 – Compliance with NEPA. GM_190_410_A. Amend. 17, March 2010.
- NRCS. 2011a. NRCS Handbooks, Title 190 – Ecological Sciences, Part 610 – National Environmental Compliance Handbook. H_190_NECH, Second Edition, March 2010.
- NRCS. 2011b. Canada Lynx *Lynx canadensis* Fact Sheet. April 2011.
- NRCS. 2012. Draft Green River Diversion Hydrologic Study. Prepared by the NRCS Salt Lake City Office.
- NRCS. 2013a. Web Soil Survey, Grand and Emery Counties, Utah. Available online at <http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>.
- NRCS. 2013b. Threatened, Endangered, and Candidate Plant Species of Utah. Technical Note TN Plant Materials No. 52.
- NRCS. 2013c. Cultural Resources Survey for the Green River Diversion Rehabilitation, Grand and Emery Counties, Utah. Prepared by G.C. Smith and A.M. Williamson, Price, Utah.
- Peterson, D. L. 1988. Nesting and habitat parameters for selected raptors in the desert of northern Utah. Master's Thesis, Utah State Univ., Logan, UT.
- SEUTP (Southeast Utah Tamarisk Partnership). 2007. Woody Invasive Species Management Plan. Available at grandcanyontrust.org/utah/invasives_actions_seutp.php.
- State of Utah. 2013a. Water Quality Standards. Available at: <http://www.rules.utah.gov/publicat/code/r317/r317-002.htm>.
- State of Utah. 2013b. Utah History to Go, Green River. Prepared by Roy Webb, Utah History Encyclopedia. Available at historytogo.utah.gov/utah_chapters/the_land/greenriver.html.
- State of Utah Natural Resources. 2000. Utah State Water Plan, West Colorado River Basin. Utah Board of Water Resources. Salt Lake City, UT. Available at <http://www.water.utah.gov/planning/swp/westcol/westcolindex.htm>.
- Thompson, Kendall R., 1984. Annual Suspended-Sediment Loads in the Green River at Green River, Utah, 1930-82. *U.S. Geological Survey Water-Resources Investigations Report 84-4169*.

- UACD (Utah Association of Conservation Districts). 2011. Grand County Resource Needs Assessment. Grand Conservation District. In coordination with the Utah Department of Agriculture and Food and the Natural Resources Conservation Service. Available at uacd.org/pdfs/.
- UACD. 2012. Emery County Resource Needs Assessment. San Rafael and Green River Conservation Districts. In coordination with the Utah Department of Agriculture and Food and the Natural Resources Conservation Service. Available at uacd.org/pdfs/.
- UCDC (Utah Conservation Data Center). 1997. Utah Gap Analysis – Predicted Habitat Golden Eagle. Available at dwrcdc.nr.utah.gov.
- UCDC. 1999. Utah Gap Analysis Breeding/Wintering Habitat Bald Eagle. DWR Neotrops Revision. Available at dwrcdc.nr.utah.gov.
- Utah Conservation Data Center (UCDC). 2011. Utah Sensitive Species List by County. Accessed online at <http://dwrcdc.nr.utah.gov/ucdc/ViewReports/sslist.htm>.
- UCDC. 2013. Make a Wildlife Map. Maps and GIS Data. Interactive mapping feature for selected game managed species in Utah. Available at dwrcdc.nr.utah.gov/ucdc.
- UDEQ (Utah Department of Environmental Quality). 2012a. *Utah's 2010 Integrated Report: Part 3:303(d) List of Impaired Water*, Division of Water Quality.
- UDEQ. 2012b. Utah Division of Air Quality 2012 Annual Report.
- UDNR (Utah Division of Natural Resources). 2009. *Utah Greater Sage-Grouse Management Plan*. Publication 09-17. Approved June 4, 2009.
- UDWR (Utah Division of Wildlife Resources). 1996. Growing Wild, The Riparian Zone. Utah's Project Wild Newsletter. Available at wildlife.utah.gov/education/newsletters/96fall-fw.pdf.
- UDWR. 2005. Utah Wolf Management Plan. Publication No. 05-17. Prepared in coordination with the Utah Wolf Working Group.
- UDWR. 2006. Range-wide Conservation Agreement and Strategy for Roundtail chub, Bluehead sucker, and Flannelmouth sucker. Prepared for the Colorado River Fish and Wildlife Council. Publication No. 06-18.
- UDWR. 2009a. Utah Aquatic Invasive Species Management Plan. Prepared in coordination with the Utah Aquatic Invasive Species Task Force. Publication No. 08-34.
- UDWR. 2009b. Bald Eagle (*Haliaeetus leucocephalus*). Wildlife Notebook Series No. 3.
- UDWR. 2011. *Utah Big Game Annual Report*. Prepared by H.H. Bernales, K.R. Hersey, and A. Aoude. Publication No. 12-27. Available at wildlife.utah.gov.

- UDWR. 2012a. GIS Species Data in Dromedary and Timpanogos Cave Quadrangles. Emery and Grand County. Utah Conservation Data Center. <http://dwrcdc.nr.utah.gov/ucdc/>. Accessed June 13, 2012.
- UDWR. 2012b. Utah's State listed Species by County: Emery and Grand County. Utah Conservation Data Center. <http://dwrcdc.nr.utah.gov/ucdc/ViewReports/sscounty.pdf>. Last Updated March 29, 2011. Accessed June 25, 2012.
- UDWR. 2012c. GIS Species Data within a 1-Mile Radius of the Project. Emery and Grand County. Received June 27, 2012.
- UDWR. 2012d. Utah Black Bear Annual Report. Prepared by H.H. Bernales and J. Shivik. Publication No. 13-14. Annual Performance Report for Federal Aid Project W-65-M, segments 60 and 61. Available at wildlife.utah.gov.
- UDWR. 2013a. Utah Hunting. Annual Hunting Reports. Available at wildlife.utah.gov/hunting-in-utah/hunting-information.html.
- UDWR. 2013b. *Utah Furbearer Annual Report 2012–2013*. Prepared by H.H. Bernales and J. Shivik. Publication No. 13-18. Annual Performance Report for Federal Aid Project W-65-M, segments 61. Available at wildlife.utah.gov.
- UDWR. 2013c. *2013-2014 Utah Upland Game and Turkey Guidebook*. Available at wildlife.utah.gov/guidebooks.
- UDWR. 2013d. *2013 Utah Fishing Guidebook. Rules, Fish Identification, Regulations, Information*. Available at wildlife.utah.gov.
- UGS (Utah Geological Survey). 2007. Landslide Susceptibility Map of Utah. Plate 1. Prepared by Richard E. Giaraud and Lucas M. Shaw.
- Upper Colorado River Endangered Fish Recovery Program. 2014. www.coloradoriverrecovery.org.
- USACE (U.S. Army Corps of Engineers). 2010. *HEC-SSP: Statistical Software Package User's Manual*, Institute of Water Resources, Hydrologic Engineering Center.
- U.S. Bureau of Labor Statistics. 2013. Current Employment Statistics (CES). Available online at bls.gov/ces/.
- U.S. Bureau of Reclamation (USBR), 2006. "Record of Decision, Operation of Flaming Gorge Dam, Final Environmental Impact Statement", USBR Upper Colorado Region, February, 2006.
- U.S. Census Bureau. 2010a. 2010 Census Interactive Population Search. Utah State, Grand County, and Emery County. Available online at census.gov/2010census/popmap.

- U.S. Census Bureau. 2010b. American Fact Finder. Selected Economic Characteristics 2007-2011 American Community Survey 5-Year Estimates. Available online at factfinder2.census.gov.
- U.S. Department of Energy. 2012. Data Validation Package: June 2012 Water Sampling at the Green River, Utah, Disposal Site".
- U.S. Department of the Interior. 1995. Gap Analysis Program State of Utah Vegetation Cover Types. Printed by the U.S. Geological Survey 1995. Available at cartoko.com/content/wp-content/uploads/2010/07/USGS_utah_vegetation.jpg.
- U.S. Department of the Interior Bureau of Land Management (USDI-BLM). 2012. BLM Sensitive Species List. Accessed online at http://www.blm.gov/ut/st/en/fo/st__george/more/biological_resources/special_status_species/sensitive_species.html.
- U.S. Energy Information Administration. 2013. State-Level Energy-Related Carbon Dioxide Emissions, 2000-2010. U.S. Department of Energy.
- USFWS (U.S. Fish and Wildlife Service). 2001. U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form, Yellow-Billed Cuckoo.
- U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. [Online version available at <<http://www.fws.gov/migratorybirds>].
- USGS (U.S. Geological Survey). 1982. Guidelines for Determining Flood Flow Frequency. *Bulletin of the Hydrology Subcommittee #17B*. Interagency Advisory Committee on Water Data.
- USGS. 2005a. National Gap Analysis Program. Southwest Regional GAP Analysis Project – Interactive Map. RS/GIS Laboratory, College of Natural Resources, Utah State University. Available at earth.gis.usu.edu/swgap/mapserver/.
- USGS. 2005b. National Gap Analysis Program (USGS). Southwest Regional GAP Analysis Project – Land Cover Descriptions. RS/GIS Laboratory, College of Natural Resources, Utah State University. Available at earth.gis.usu.edu/swgap/legend_desc.html.
- USGS. 2006. Hydrology and Water Quality in the Green River and Surrounding Agricultural Areas near Green River in Emery and Grand Counties, Utah, 2004-05. *Scientific Investigations Report 2006-5186*.
- Utah Division of Water Quality. 2013. 2010 Water Quality Assessment. Available at: <http://www.waterquality.utah.gov/WQAssess/index.htm>.
- Utah Division of Water Rights (UDWRi). 2013. Water Rights Listings for Township 20S Range 16E, Sections 17 and 16. Accessed at: <http://www.waterrights.utah.gov/wrinfo/default.asp>.

Utah Native Plant Society, 2013. Utah Rare Plant Guide, http://www.utahrareplants.org/rpg_species.html.

Utah State Legislature. 2012. Title 19 Environmental Quality Code, Chapter 5 Water Quality Act. <http://www.le.utah.gov/UtahCode/section.jsp?code=19-5>. Accessed November 11, 2012.

Utah State Parks. 2009. *Utah State Comprehensive Outdoor Recreation Plan*. Division of Utah State Park and Recreation Planning Section. Salt Lake City, Utah.

Utah State Parks. 2013. Green River State Park, Park Amenities Facilities and Services. Division of Utah Department of Natural Resources. Salt Lake City, Utah. Available online at stateparks.utah.gov/park/green-river-state-park/amenities.

Utah State University. 2005. Emery and Grand County Agricultural Profile. http://extension.usu.edu/files/publications/publication/AG_Econ_county-2005-28.pdf. Accessed June 18, 2012.

Utah State University. 2013. Cooperative Extension. Range Plants of Utah. Russian Olive. Available at extension.usu.edu/rangeplants/htm/russian-olive.

UWCA (Utah Weed Control Association). 2013. Utah's Noxious Weed List. Available at utahweed.org/weeds.htm.

UWRL (Utah Water Research Laboratory). 2010. Green River Canal Sedimentation and Flow Distribution Project. Available at uwrl.usu.edu/researchareas/waterresources/greenrivercanal.html.